Clinical Reasoning by Expert Bobath Instructors

by

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Abstract

**Background:** Clinical reasoning, a complex clinical skill, is central to professional accountability but currently invisible in the rehabilitation sciences evidence base with an associated under-development of underpinning theory. Understanding and minimizing movement problems is a focus of rehabilitation. Movement performance is a key aspect of Bobath clinical practice, the most widely used neuro-rehabilitation approach. To date there are no publications addressing the clinical reasoning process or the conceptualization of movement by Bobath therapists despite considerable investigation of the effectiveness of this rehabilitation approach.

**Purpose:** To address this research gap, this dissertation aimed to develop an interpretive understanding of the clinical reasoning process of expert Bobath therapists.

**Methods:** To accomplish this aim, a modified e-Delphi method was used to define a Bobath Clinical Framework. A qualitative research approach was adopted for the second study using Interpretive Description methodology to explicate a conceptual understanding of movement and the clinical reasoning process of expert Bobath therapists.
Results: Eight statements representative of the conceptual framework, and three assumptions and eight principles representing key aspects of clinical practice reached consensus in the modified e-Delphi successfully identifying a Bobath Clinical Framework. Twenty-two IBITA instructors participated in the Interpretive Description study identifying three key elements integral to the instructors’ conceptualization of movement, specifically the integration of postural control and selective movement, and the unique role of visuo-spatial kinesthetic perception, an aspect of practical wisdom, in the clinical reasoning process.

Conclusions: The development of a Bobath clinical framework and explication of the Bobath therapists’ conceptualization of movement formed a practice epistemology exposing and illustrating the critical role of phronesis (practical wisdom), in the clinical reasoning process. This thesis highlights the need for a multi-dimensional knowledge base, procedural and conditional knowledge, in addition to declarative knowledge, necessary for clinicians to make wise judgments with respect to individual clients, the clinical reasoning process.
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Chapter 1
General Introduction

Clinical reasoning is at the core of effective health care practice. It is how the clinician manages the complexity, uncertainty, instability and uniqueness of clinical practice (Schon, 1983)(p.14), and is dependent upon content knowledge and practical experience using critical thinking abilities (Bartlett & Palisano, 2002; Brookfield, 2008). It is an ongoing iterative process between present action, past experience and intentions for the future (McAlpine, Weston, Beauchamp, Wiseman, & Beauchamp, 1999) and therefore is difficult to explain, demonstrate and assess (Christie, Worley, & Jones, 2000)(p.148).

It is professional judgment, through the clinical reasoning process, which determines if a specific intervention is relevant, reasonable and appropriate in the individual client’s presentation and context (Fish & Higgs, 2008)(p.29). However, consensus is lacking on the essential components of sound clinical reasoning (Loughlin et al., 2012). Reliance on empirical research findings including causal mechanisms is insufficient as an appreciation of the individual person including respect, empathy and compassion is essential (Loughlin et al., 2012). In fact the current rehabilitation science evidence base suffers from the inability to generalize research findings to specific patient populations, as well as the inability to apply findings to individual patients with unique characteristics (D. U. Jette et al., 2003). It is the wise integration of knowledge and clinical expertise that affords sound clinical reasoning (Loughlin et al., 2012). Professional judgment in the health sciences occurs against the background of a clinical framework therefore understanding clinical reasoning requires a philosophical stance in as much as one needs to articulate the assumptions and principles that underpin practice (Loughlin et al., 2011);(Loughlin et al., 2012).

1.1. Overview of the thesis

This dissertation explores the clinical reasoning of expert Bobath therapists. The Bobath concept is the most widely used neurorehabilitation approach for persons with neurological conditions (Kollen et al., 2009). A hallmark of the Bobath concept is its interaction between assessment and treatment (Bobath, 1978), providing fertile ground for studying the clinical reasoning process.
utilized by therapists in neurorehabilitation. The explication of the assumptions and principles underpinning Bobath clinical practice and an understanding of how these therapists conceptualize movement is fundamental to understanding expert Bobath therapists’ clinical reasoning process.

The thesis is organized as follows: Chapter One provides an overview of human movement, neurological rehabilitation, physiotherapy theory, the relationship between knowledge, clinical reasoning and expertise, and a brief introduction to the Bobath concept. Chapter Two presents my Positionality Statement, the research aims and objectives and an overview of the research methods used. Chapter Three details the research study undertaken to develop a Bobath clinical framework. Chapters Four and Five respectively detail the study undertaken to understand how expert Bobath therapists conceptualize movement and an explication of the Bobath clinical reasoning process. Chapter Six discusses: (i) The role of theory in rehabilitation clinical practice and research; (ii) How the conceptualization of movement is integral to the Bobath clinical reasoning approach; and, (iii) The overarching theme of the integration of postural control and selective movement with respect to contemporary theories of motor control and neuroscience, and implications for clinical practice and research.

1.2. Literature Review

1.2.1. Physiotherapy Theories

Unlike other health professions such as Nursing and Occupational Therapy, development of theory has not been a major focus of Physiotherapy (Bithell, 2005). Physiotherapy has lacked an over-arching theoretical framework essentially borrowing theoretical knowledge from the biomedical, physical and social sciences (Gibson, Nixon, & Nicholls, 2010). Conceptually physiotherapy places human movement at its centre (Beeston & Simons, 1996), from a body perspective, and also from the perspective that human movement is essential to life, fulfilling bodily demands, enabling relationships and socio-cultural participation (Wikstrom-Grotell & Eriksson, 2012);(Nicholls & Gibson, 2010). Attempts to develop a grand theory of Physiotherapy have come from three main groups: Hislop (1975); Cott et al. (1995); and Sahrmann (2014).
1.2.1.1. The Pathokinesiology Theory

Dr. Helen Hislop presented a philosophical overview of physical therapy in the Tenth Mary McMillan Lecture at the fifty-first annual conference of the American Physical Therapy Association in June 1975. Dr. Hislop proposed a grand theory of human movement positing ‘Pathokinesiology’, or abnormal human movement, as the distinguishing clinical science of physical therapy, claiming the role of exercise in health and disease as unique to physical therapy and defining a hierarchy of systems based on six levels of the natural system from cells, tissues, organs, systems, person to family (Hislop, 1975). However this theoretical perspective of human movement does not explicitly incorporate the sociocultural and environmental influences on human movement (C. A. Cott et al., 1995), nor does it consider the role of physical therapy in wellness, prevention, incurable or chronic illnesses (Pratt, 1989);(Schlegel, 1986).

Hislop’s attention to the need to develop a grand theory for physiotherapy facilitated debate not only on physiotherapy theory (Rothstein, 1986) but also diagnosis and classification, or a physiotherapy taxonomy, as it was recognized that a medical diagnosis does not sufficiently represent physiotherapy practice (Rose, 1988);(Sahrmann, 1988);(Thornquist, 1994). Unfortunately the concept of developing a physiotherapy taxonomy, or physiotherapy frameworks has not received considerable attention (A. M. Jette, 1989);(Coffin-Zadai, 2007);(Norton, 2007); (Ludewig, Lawrence, & Braman, 2013) despite the focus of current rehabilitation science on effectiveness of interventions.

1.2.1.2. The Movement Continuum Theory

Further work on physiotherapy theory did not emerge for another twenty years until Cott et al. (1995) published the ‘Movement Continuum Theory’ (MCT) as a grand theory of PT with movement as the key concept (C. A. Cott et al., 1995). Cott et al. (1995) acknowledge that movement is not unique to physiotherapy, but how physiotherapists conceptualize movement is unique to the profession. The MCT posits that physiotherapists consider the social, cultural, psychological and environmental influences on movement, not only movement of a body segment or body as a whole (C. A. Cott et al., 1995). Within the MCT movement is considered as a continuum from micro, the molecular level, to macro, the person in society level, from which three distinct movement possibilities arise: (i) the maximal achievable movement potential (MAMP) or the person’s theoretical maximum ability to move; (ii) the preferred movement
capability (PMC) or how the person wants to be able to move; and, (iii) the current movement capability (CMC) or how the person is currently able to move (C. A. Cott et al., 1995).

Movement can be considered in these terms in the presence or absence of pathology therefore addressing all aspects of physiotherapy from prevention and wellness to chronic and incurable conditions to pathology arising as a result of movement. Consideration of movement in terms of the MAMP, the PMC and the CMC frames the purpose of physiotherapy interventions, to reduce the differential between the PMC and the CMC within the context of the MAMP individual to the individual.

Despite the obvious clinical applicability of the MCT and its inclusion in the World Confederation of Physical Therapy definition of physical therapy (WCPT, 2011) there has been limited application of this theoretical perspective on movement within physiotherapy clinical practice. Within the construct of movement the elements that are of importance to clinicians have undergone limited empirical research (Allen, 2007); (Skjaerven, Kristoffersen, & Gard, 2008), and there is no evidence identifying the elements of movement important to clients. This is surprising as the terms movement quality or performance are terms frequently used by physiotherapists. These terms are potentially the elements of interest in reducing the PMC and CMC differential and are possibly one of the reasons why clients seek physiotherapy interventions.

1.2.1.3. The Human Movement System Theory

Almost another twenty years passed before the debate on physiotherapy theory resurfaced in the literature with the American Physical Therapy Association (APTA) proposing and adopting the concept of a ‘Human Movement System” (HuMS) (Sahrman, 2014). Sahrmann et al. (2014) posit that a ‘physiological system’ is necessary as the foundational science of physical therapy to gain recognition of the professions expertise with respect to a movement system rather than movement alone. The HuMS is presented as a movement-related physiological organ system, with the musculoskeletal and nervous systems identified as primary effector systems and the pulmonary, cardiovascular and endocrine systems as the primary support systems (Sahrman, 2014) thus clearly immersed in a medically oriented perspective. The HuMS discusses prevention/wellness and movement dysfunction in terms of pathokinesiology and kinesiopathology with respect to the terminology normal and abnormal movement. From the
HuMS it is not clear how the social, cultural and environmental influences on movement interact with the model, nor the role of the person rather than the body. The HuMS appears to be focused towards the musculoskeletal aspects of physical therapy practice. The application of HuMS to neurological conditions is limited since the movement dysfunction arising from neurological conditions cannot be described as pathokinesiology or kinesiopathology because the movement dysfunction affects the whole person within their sociocultural and environment context. Additionally, persons experiencing neurological movement dysfunction should not be considered abnormal. Interestingly the HuMS makes no reference to the MCT’s contribution to the debate on physical therapy theory.

In summary, contributions to the debate on physiotherapy theory have been made by three main groups (Hislop, 1975); (C. A. Cott et al., 1995); (Sahrmann, 2014). However, there is no clear consensus on an overarching conceptual framework for physiotherapy with differing views emerging (C. A. Cott et al., 1995); (Sahrmann, 2014) yet all focused on the concept of movement. Investigation of the construct of movement from the clinical perspective may provide an opportunity to illustrate the available theoretical models.

1.2.2. Neurological Rehabilitation and Evidence Based Practice

1.2.2.1. Prevalence of Neurological Conditions

Neurological conditions have significant personal, financial and economic costs (Wissel, Olver, & Stibrant Sunnerhagen, 2013). An estimated 10 million people/year globally suffer a traumatic brain injury, and the incidence of spinal cord injury worldwide is reported to be 46-81 per million population (Bragge et al., 2012). Stroke, a neurological condition, is the leading cause of long-term disability in adults in Canada (Johansen, Wielgosz, Nguyen, & Fry, 2006). In 2013 an estimated 405,000 Canadians, of which 88% were community-dwelling, were living with the effects of stroke (Krueger et al., 2015). The prevalence of stroke increases significantly with age, and although in Canada prevalence rates between 2000-2013 have remained relatively stable, the number of individuals affected by stroke increased by 95,000 due to aging and population growth (Krueger et al., 2015). It is estimated that by 2038 the number of people affected by stroke in Canada will be between 654,000-726,000 (Krueger et al., 2015), therefore placing a significant demand on rehabilitation resources (Johansen et al., 2006).
1.2.2.2. Stroke-related Disability

Recent advances in the acute management of stroke have reduced stroke mortality, whilst simultaneously increasing the likelihood that individuals are living with the effects of stroke (J. D. Edwards, Koehoorn, Boyd, & Levy, 2010). It is estimated of those Canadians who sustain a stroke, 75% will have a residual disability, 40% of which will have moderate to severe impairments (Teasell, Meyer, Foley, Salter, & Willems, 2009). Increased stroke severity is associated with major motor symptoms, such as reduced upper limb and hand function, leading to a reduction in health related quality of life (HRQOL) (J. D. Edwards et al., 2010). In fact in Canada overall HRQOL and HRQOL specific to impairment in dexterity and cognition decreased over the period 1996-2005 (J. D. Edwards et al., 2010). A primary goal of neurological rehabilitation, of which the Bobath concept is one of the most widely used approaches, is the resolution of individual movement problems thereby optimizing functional independence (VGraham, Eustace, Brock, Swain, & Irwin-Carruthers, 2009). Therefore access to effective and efficient neuro-rehabilitation services across the continuum of care is essential in order to optimize recovery and minimize disability (Kitago & Krakauer, 2013).

1.2.2.3. Evidence-Based Neurorehabilitation

The evidence-based practice (EBP) movement over the past three decades has transformed the landscape of clinical rehabilitation research giving preference to the investigation of intervention effectiveness (Costa, Maher, Lopes, de Noronha, & Costa, 2011);(Bluhm & Borgerson, 2011). Although Sackett’s (1996) (p.71) definition states:

“The practice of evidence based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research”

acknowledging the importance of clinical expertise, many rehabilitation scientists have uncritically embraced the randomized controlled trial (RCT) as the ‘gold standard’ for evidence (Hyde, 2004), originally developed to demonstrate the efficacy of new drugs, effects of surgery and accuracy of diagnostic tests (Bluhm & Borgerson, 2011). For example, the Canadian Stroke Best Practices Recommendations (Canadian Stroke Strategy, 2010), and a recent ‘Best-Evidence Synthesis’ evaluating the effectiveness of the Bobath concept (Kollen et al., 2009) are compiled from evidence derived solely from RCT’s. However, the synthesis of this evidence did not provide any clear clinical directions.
Neurorehabilitation research has specific needs including: (i) clear characterization of clients included as subjects, a medical diagnosis alone is insufficient; (ii) clear and up-to-date theoretical and clinical frameworks of the proposed interventions; (iii) clear descriptions and operationalization of the interventions under study; (iv) identification of the level of expertise of the clinicians providing the interventions; (v) a clearly outlined process to evaluate intervention adherence; (vi) a clear description of the clinical reasoning process utilized ensuring individualized client-centred care; and (vii) outcome measurement documenting clinician and client meaningful change (Vaughan-Graham, Cott, & Wright, 2015a). The majority of these issues are identified in the extended ‘Consolidated Standards of Reporting Trials’ (CONSORT) statement (Begg et al., 1996); (Moher, Schulz, Altman, & for the Consort Group, 2001); (Boutron, Moher, Altman, Schulz, & Ravaud, 2008) and mandatory use of reporting guidelines (Chan, Heinemann, & Roberts, 2014). The specific needs of neurorehabilitation research are also an essential aspect of study design in order to establish study and treatment fidelity on which determining causality is dependent (Hart & Bagiella, 2012); (Hildebrand et al., 2012). However, the lack of operationalization and description of interventions continues to remain one of the major limitations in neurorehabilitation research (Page, Schmid, & Harris, 2012), as well as a lack of attention to technical competence and expertise (Nicholls & Holmes, 2012); (Verheyden, Handgraaf, Demirci, & Gruneberg, 2011) and no description of the clinical reasoning process required for individualized client-centred care (Vaughan-Graham et al., 2015a).

The focus of the neuro-rehabilitation sciences evidence base on determining the effectiveness of interventions using traditional experimental designs has resulted in an inconsequential focus on other forms of evidence, such as professional practice knowledge, or even the role of the client in the decision-making process. Physiotherapy, and by extension, rehabilitation practice, is complex and multifactorial and therefore requires a multi-dimensional evidence base (Shaw, Connelly, & Zecevic, 2010). Whereas, the positivist (reductionist) paradigm privileges propositional (scientific) knowledge, professional craft knowledge (knowing how to do something), and personal knowledge (accrued from life’s experiences) draws upon the constructivist and critical theorist research paradigms providing context (Plack, 2005). Whilst an essential aspect of healthcare research and provision, the reductionist approach lacks the integration of the larger context in which clinical interventions occur such as the psychological, emotional, spiritual and sociocultural dimensions (Miles & Loughlin, 2011), as well as the
clinician’s technical competence and expertise (Nicholls & Holmes, 2012). This suggests that scientific knowledge alone embedded within the positivist paradigm is insufficient for clinical decision-making. The decision with respect to an intervention requires consideration of the client in his or her entirety (Miles & Loughlin, 2011) and is therefore reliant upon professional judgment, the clinical reasoning ability of the clinician (Fish & Higgs, 2008).

However, the role of clinical reasoning in professional practice, the understanding of ‘why’ a therapist chooses a particular intervention, has largely been ignored in the current rehabilitation sciences evidence base (Higgs, Burn, & Jones, 2001);(Kinsella & Pitman, 2012), with an accompanying under-development of the theory underpinning the clinical reasoning process (Ian Edwards, Jones, Carr, Braunack-Mayer, & Jensen, 2004);(Durning, Artino, Schuwirth, & van der Vleuten, 2013).

1.2.3. Clinical Reasoning & Clinical Expertise

Clinical reasoning has been described as a ‘vital skill’ for the therapy professions (Leicht & Dickerson, 2002). It is a complex process, dependent upon the integration of theoretical knowledge and professional practice experience, in the context of the clinical setting (Christie et al., 2000);(Ian Edwards et al., 2004). The utilization of knowledge, both theoretical and clinical, and its integration into clinical practice is dependent upon experience (Hicks, Merritt, & Elstein, 2003), the organization and structure of knowledge, as well as it being efficiently retrievable (Noll, Key, & Jensen, 2001). Not surprisingly, the bodies of literature related to clinical reasoning and clinical expertise have evolved concurrently, indicating the interdependence of these two aspects relative to clinical practice (Joy Higgs & Mark Jones, 2000). Clinical reasoning is considered a core competency of health professional education and an essential aspect of effective clinical practice (E. B. Cruz, A. Moore, & V. Cross, 2012a). Thus the understanding of clinical reasoning is central to professional accountability and autonomy, and is therefore the very essence of evidence-based practice (Bartlett & Palisano, 2002);(Ajjawi & Higgs, 2008);(Wainwright, Shepard, Harman, & Stephens, 2011).

Contributions to the rehabilitation therapy clinical reasoning literature have been made by three main groups. Formative work by Mattingly & Fleming (1994) identified four clinical reasoning strategies: (i) procedural (hypothetical) reasoning, is the consideration of techniques and procedures to solve the specific physical problem; (ii) interactive reasoning, is utilized to better
understand the client as a person; (iii) conditional reasoning considers the client in their broader social and temporal contexts; and, (iv) narrative reasoning which frames the treatment process in a temporal context providing a basis for organizing tasks (Mattingly & Fleming, 1994).

Jensen and colleagues further developed the concept of clinical reasoning with specific reference to the expert practice of physical therapists (G. M. Jensen, Shepard, & Hack, 1990); (G. M. Jensen, Shepard, Gwyer, & Hack, 1992); (G. M. Jensen, Gwyer, Shepard, & Hack, 2000). They demonstrated that there is a clear difference in how novice and expert practitioners practice, specifically in the knowledge they hold and in the way they interact with their patients (G. M. Jensen et al., 1990); (Shepard, Hack, Gwyer, & Jensen, 1999); (Wainwright et al., 2011). Studies on clinical expertise have demonstrated that the differences in the performance of novice and expert clinicians are predominantly due to their clinical reasoning abilities (Unsworth, 2001). A core feature of the expert clinician is their ability to combine knowledge with experience, to know what is important, and to recognize and appreciate the significance of critical cues (Kristensen, Borg, & Hounsgaard, 2012); (Wainwright et al., 2011); (Megan Smith, Joy Higgs, & Elizabeth Ellis, 2008); (Mitchell & Unsworth, 2005); (G. M. Jensen et al., 1990).

Edwards et al. (2004) expanded on previous work suggesting that physical therapists combine hypothetico-deductive, instrumental, narrative and communicative reasoning strategies dialectically, proposing a dynamic interplay between different knowledge sources and reasoning strategies used within a clinical encounter (Ian Edwards et al., 2004). The knowledge that clinicians bring to the clinical encounter is a primary feature of the therapeutic intervention (G. M. Jensen et al., 1992), and this knowledge takes three forms: 1) propositional (scientific) knowledge; 2) professional craft knowledge (knowing how to do something); and, 3) personal knowledge (accrued from life’s experiences) (Higgs & Titchen, 2001)(p.5). It has also been identified that it is the cognitive development of the individual clinician, which facilitates knowledge use (in the broad sense) in clinical practice and also enables knowledge generation through clinical practice (Christensen, Jones, Higgs, & Edwards, 2008); (Joy Higgs & Mark Jones, 2000)(p.7-8). Expert clinicians apply theory in a variety of ways in order to make it useful to particular patients, in their specific situations, as well as generating new knowledge in the form of practice principles (Carrier, Levasseur, Bédard, & Desrosiers, 2010); (Higgs & Titchen, 2001).
More recently, Wainwright et al. (2011) expanded on the differences between novice and experienced physical therapists clinical reasoning abilities with particular reference to reflective practice (Wainwright, Shepard, Harman, & Stephens, 2010). Two further studies by Cruz et al., (2012), identified expert musculoskeletal physiotherapists and final year physiotherapy students as using a clinician-centred reasoning approach (Cruz et al., 2012a);(E. B. Cruz, A. P. Moore, & V. Cross, 2012b). This is in contrast to the clinical reasoning literature already discussed, and as these studies were undertaken in Portugal, is perhaps an indication that educational and practice context may influence clinical reasoning (Carrier et al., 2010).

The interdependence between theoretical knowledge and professional practice experience, the professional practice knowledge that a therapist develops through clinical experience and how this contributes to the clinical reasoning process, has largely been ignored in the current rehabilitation sciences evidence base (Higgs & Titchen, 2001)(p.45);(Nicholls & Holmes, 2012). To date, conceptual reasoning frameworks remain relatively general to the practice of therapy (Ian Edwards et al., 2004);(Schenkman, Deutsch, & Gill-Body, 2006);(Wainwright et al., 2011), suggesting that research is needed to explore the clinical reasoning process of expert clinicians in specialty areas (Noll et al., 2001);(Norman, 2005);(Carrier et al., 2010), such as neurorehabilitation.

1.2.4. The Bobath Concept

The Bobath concept is one of the most widely used neuro-rehabilitation approach worldwide (Kollen et al., 2009);(Vaughan-Graham et al., 2015a). It was conceived by Dr. and Mrs. Bobath in the early 1940’s as an alternative to the compensatory rehabilitation of the time, and is based on the recovery potential of movement following a lesion of the central nervous system (Vaughan-Graham, Cott, & Wright, 2015b). The International Bobath Instructors Training Association (IBITA) is considered the international expert Bobath association for adult neurorehabilitation. It was formed in 1984 by the Bobath’s along with a small group of Bobath instructors, to facilitate the ongoing interaction of current instructors as well as training of future instructors (Vaughan-Graham et al., 2015b). Since 1990, the IBITA membership of qualified instructors has grown from 91, to 252, in 2015, representing 29 countries worldwide, with currently 39 therapists in the IBITA instructor training process (www.ibita.org).
The Bobath concept is an inclusive approach with respect to diagnosis, age and stage of disability (Raine, 2009), and is described as:

“An inclusive, individualized problem-solving living concept based on a systems approach to motor control, with particular emphasis on movement analysis and motor recovery from the perspective of the integration of postural control, task performance and contribution of sensory inputs” (Vaughan-Graham et al., 2015b)(p.1804).

Thus an understanding of human movement is an essential aspect of Bobath clinical practice. However, to date, Bobath therapist’s conceptualization of movement has not been investigated. Proponents of the Bobath concept emphasize the complex clinical reasoning process, enabling a continuously evolving treatment, response-based to the client and context (Johnson, 2009);(VGraham et al., 2009). Hence, they argue, it is an approach grounded not only in the science, but the art of neurorehabilitation, the development of professional craft knowledge alongside scientific knowledge, bounded by the clinician’s life experiences and humanity such that the individuality of the person with the neurological condition is always addressed.

Mrs. Bobath published three books with respect to rehabilitation of the adult following stroke (Bobath, 1970);(Bobath, 1978);(Bobath, 1990). Since her last publication in 1990, until 2006, there has been limited peer-review publication on the theoretical and clinical evolvement of the Bobath concept (S Lennon, 1996);(S Lennon & Ashburn, 2000);(S Lennon, Baxter, & Ashburn, 2001). A recent scoping review of Bobath publications over the period 2007-2012 identified several gaps in the literature including a need to clarify key aspects of Bobath clinical practice whilst also recognizing that the Bobath concept is not a single intervention (Vaughan-Graham et al., 2015b);(Vaughan-Graham et al., 2015a).

The focus of the Bobath concept on movement performance and analysis provides an excellent model to investigate the construct of movement in neurological physiotherapy practice as how these therapists conceptualize movement is integral to clinical reasoning. These findings will be discussed with respect to a developed Bobath clinical framework.
1.3. Summary

Due to the focus of research on treatment effectiveness over the past three decades as a result of the pervasive nature of the positivist paradigm within the biomedical and physical sciences evidence base there has been a subsequent lack of the development of theory, which is essential to the progression of any science or clinical practice. Physiotherapy is no exception with no clear theoretical unifying framework with respect to human movement and therefore no theoretical foundation on which to base clinical reasoning. To date, clinical reasoning has been described in terms of the cognitive capacity of the clinician and in particular with respect to the concurrent development of expertise. However, the role of professional practice knowledge, experience and thus practical wisdom has received little attention in the clinical reasoning literature.

Based on the gaps identified in the literature, the purpose of this thesis is to develop an interpretive understanding of the expert Bobath therapist’s clinical reasoning process by explicating the assumptions and principles underpinning Bobath clinical practice and how these therapists conceptualize movement.

The next chapter will discuss this author’s position with respect to the program of research, the research aims, objectives and an overview of the methods used.
Chapter 2
Positionality Statement, Research Aims and Methods

2.1. Positionality Statement

2.1.1. Physiotherapy Background

I am a physiotherapist and have been practicing clinically in the area of adult neurological rehabilitation for thirty years. I have always been interested in the analysis of human movement and how physiotherapy influences human movement to optimize the movement abilities of my clients, especially following a lesion of the central nervous system. I became interested in the Bobath concept in 1993 while watching a Bobath instructor treat one of my clients, a young woman with an incomplete cervical spinal cord injury. During one clinical session the Bobath instructor significantly changed my client’s movement performance demonstrating my client’s movement potential that until that moment I did not believe was possible. From 1995 to 2008 I pursued my professional education in the Bobath concept with the International Bobath Instructors Training Association (IBITA) qualifying as an IBITA Basic Course instructor in 2001, and as an IBITA Advanced Course instructor in 2008. I instruct post-graduate clinical education courses in the Bobath concept nationally and internationally with a special interest in the rehabilitation of the incomplete spinal cord injured individual.

2.1.2. Juxtaposition with the Evidence-Base

Although the effectiveness of the Bobath concept was confirmed through my professional practice, scientific evidence demonstrating the effectiveness of the Bobath concept was lacking (Paci, 2003). Mrs. Bobath published her last book in 1990 (Bobath, 1990). From 1990 until 2006 there were no publications in English language peer-review journals by IBITA instructors on the evolution of the Bobath concept. Thus the academic and research community during this time were limited to outdated texts (Bobath, 1970);(Bobath, 1978);(Bobath, 1990) or articles authored by researchers who were not experts in the Bobath concept (S Lennon, 1996);(S Lennon & Ashburn, 2000);(S Lennon et al., 2001) when developing studies or informing themselves on the Bobath concept. Simultaneously, with the advent of evidence-based practice over the last two decades there has been an increasing focus on determining the effectiveness of
interventions using experimental designs such as the Randomized Controlled Trial (RCT) (Costa et al., 2011). However, the delivery of a package of interventions to a group of clients identified by their medical diagnosis, not by their movement problems, is the antithesis of client centred neurological rehabilitation. A hallmark of the Bobath concept is its interaction between assessment and treatment and thus the clinical reasoning process (Johnson, 2009). It is through this clinical reasoning process that the therapist determines an evolving individualized intervention plan (C. Cott, Vaughan-Graham, & Brunton, 2011). However, the lack of consideration of the individualized nature of clinical practice, and role of professional practice knowledge and clinical skill in effectiveness study design has resulted in a less than optimal Bobath evidence base (Vaughan-Graham et al., 2015a), and was a primary motivator for me to pursue graduate studies.

2.1.3. Research Program

Over the period of 2005-2010 I pursued an MSc (part-time) at Leeds Metropolitan University in the UK with my studies focusing on the Bobath concept, during which I developed my thesis on the ‘Clinical Reasoning Process of expert Bobath therapist’s. However due to time and financial limitations of the MSc program my thesis was developed as a pilot study, was limited to three participants, but proved that the clinical reasoning of IBITA instructors could be successfully investigated in the clinical setting. My Masters study culminated in the development of a preliminary Bobath clinical framework and clinical reasoning model (Vaughan-Graham, 2010).

In addition, since 2006 there has been a concerted effort by IBITA instructors to publish updated theoretical assumptions with respect to the contemporary Bobath concept in peer-review journals (Raine, 2006); (Raine, 2007b); (VGraham et al., 2009); (M F Levin & Panturin, 2011).

In September 2011, I commenced my doctoral studies in the Rehabilitation Sciences Institute at the University of Toronto. As part of my studies I undertook a Scoping Study of the Bobath evidence-base over the period 2007-2012. The results of the Scoping Study highlighted that the majority of experimental studies failed to clearly describe the Bobath concept theoretically and clinically, and the Bobath concept was used as the comparison group most frequently (Vaughan-Graham et al., 2015a). To date a Bobath clinical framework, a Bobath clinical reasoning approach and clear descriptions of Bobath interventions continue to be lacking in the evidence (Vaughan-Graham et al., 2015b). It is for these aforementioned reasons that I was motivated to
pursue my doctoral studies as this clinical information is essential to understand how therapists provide individualized care and to provide a foundation of knowledge with respect to the Bobath concept enabling appropriate investigation (Vaughan-Graham et al., 2015a). It is therefore necessary to acknowledge that from a research perspective I am considered an ‘Insider’ and thus my disciplinary and scientific knowledge will influence the view taken with respect to my doctoral studies.

As a clinician I am interested in individualized client care and became increasingly frustrated by the significant gap between research evidence and clinical practice. The focus on the positivist paradigm of only ‘one’ truth did not reflect my actual clinical practice as an intervention for one client maybe appropriate but maybe inappropriate for another client even if their movement problems were similar. I believe understanding why a therapist makes a specific clinical decision is equally if not more important than the actual clinical intervention. I am therefore interested in the process, a human behavior, not a specific intervention. I was therefore drawn to qualitative research as it allows the discovery, description and exploration of human behavior (Carpenter & Suto, 2008)(p.98). Qualitative research acknowledges there is more than one truth and that one’s values and beliefs will influence the research enquiry (Carpenter & Suto, 2008)(p.5). Clinical reasoning, with respect to the Bobath concept, is a human behavior that has not been described, documented or interpreted despite the fact that the Bobath concept is the subject of numerous studies attempting to determine its effectiveness (Kollen et al., 2009). Knowledge of Bobath clinical reasoning resides in expert clinical practice but has not been explored. Gaining an improved understanding within the practice context would have clinical utility and inform clinically relevant research. Thus I am interested in developing discipline specific knowledge that has utility in the clinical and research domains and hence my decision to pursue my doctoral studies using the qualitative research approach ‘Interpretive Description’.

Interpretive Description developed as a qualitative research approach to enable the development of disciplinary knowledge in the applied health sciences (Sally Thorne, 2008)(p.67). Therefore, knowledge of the discipline that is the focus of study is a pre-requisite to engaging in Interpretive Description. Discipline specific knowledge provides the researcher with a level of insight throughout the development of the study but particularly during data analysis, the drawing of conclusions and implications related to the findings (Sally Thorne, 2008)(p.68). Thus the researcher becomes a tool within the research. It is therefore important for this author, the
primary researcher, to acknowledge the nature of my discipline specific knowledge and motivations to engage in the studies, which, in turn, will inform the data collection and analysis.

Being an ‘Insider’ presents benefits and challenges within the research environment. My membership and participation in IBITA provides easy access to the international expert Bobath association. My knowledge of IBITA’s structure, its committee’s and its members was essential to the feasibility of the study designs. As a fellow IBITA instructor the study participants were assured that I brought a shared understanding of the topic under investigation, that their transcripts would be transcribed verbatim with tacit understanding, and not misrepresented. However, to ensure the study’s success I was required to develop a new role of clinician researcher within IBITA. It was necessary for me to take on the role of ‘not knowing’ and to not allow (to the best of my ability) my expertise to shape the interview. To assist in this process I developed an interview guide with an introductory paragraph detailing explicitly the purpose of the interview (Appendix A)(p.148). In addition, the initial data collection process was designed specifically as non-participant observation to limit any potential clinical involvement. During the interview process I had to be constantly aware of my implicit understanding and therefore prompt for clarification rather than accept statements or assumptions. Some IBITA instructors may have chosen to, or chosen not to, participate in this study because I was the researcher. Similarly, participants may have shaped their clinical session and interview specifically for the study because of my knowledge base and instructor status. Acknowledging discipline specific knowledge and the inherent biases associated with being an insider permitted the data analysis to progress inductively generating findings that are grounded within the data. To remain vigilant with respect to the challenges of being an insider I maintained a reflective journal documenting my thoughts, theoretical perspectives, clinical opinions and interpretations to understand the implications of my role throughout the research process.

2.2. Research Aims

The purpose of this thesis is to develop an interpretive understanding of expert Bobath therapists’ clinical reasoning process. To achieve this aim the assumptions and principles implicit within Bobath therapists’ clinical practice requires articulation to understand their frame of reference guiding their clinical practice. Expert Bobath therapist’s are solving movement problems through their clinical reasoning, therefore a further aim and integral to the understanding of
clinical reasoning is to understand how these therapists conceptualize movement. Through these
research aims this dissertation will develop discipline specific knowledge that has clinical and
research utility and has been identified as lacking in the literature.

The following research objectives were identified for this dissertation:

2.2.1. **Research objective 1:**
   To gain consensus on a Bobath clinical framework
   
   a) To gain consensus on the underlying conceptual framework on which a Bobath
      therapist bases clinical interventions
   
   b) To gain consensus on the assumptions and principles that identify key aspects of
      Bobath clinical practice

2.2.2. **Research objective 2:**
   To explicate a conceptual understanding of movement
   
   a) To identify which aspects of movement performance are critical to the
      conceptualization of movement

2.2.3. **Research objective 3:**
   To explicate the clinical reasoning process
   
   a) To enable the development of an interpretive model of clinical reasoning in an expert
      group
   
   b) To inform future efficacy studies with respect to the Bobath concept

Two studies were conducted in order to achieve these research objectives:

**Modified e-Delphi study:** Chapter Three represents published work that sought the opinions
of the international expert Bobath association (IBITA) on a Bobath clinical framework
addressing Research Objective One. This was accomplished through three rounds of a
modified e-Delphi process and resulted in the identification of the unique components of
Bobath clinical practice addressing a significant gap in the current Bobath evidence base.
The explication of these therapist’s clinical framework, the assumptions and principles underpinning clinical practice, laid the foundation for further investigation of their conceptualization of movement and clinical reasoning process.

**A Qualitative Research Approach using Interpretive Description Methodology:** A qualitative research approach was undertaken to address research objectives two and three enabling investigation of a complex process in an actual clinical setting. The purpose of this study was to generate discipline specific knowledge that has clinical utility advancing the understanding of experiential tacit knowledge.

Chapter Four represents work that is in preparation for submission for publication and presents the findings as to how therapists conceptualize movement as they work with clients with neurological conditions.

Chapter Five represents work that is in preparation for submission for publication and presents the findings illustrating the role of professional practice knowledge, phronesis also known as practical wisdom, in the clinical reasoning process.

IBITA is an international organization representing two hundred and fifty-five instructors from 29 countries. The universal language used in IBITA is English. All instructors are expected to have sufficient comprehension and spoken skills in English for communication purposes. All Annual General Meetings in IBITA are conducted in English. Therefore, all written and verbal communication for the studies in this dissertation involving IBITA were undertaken in English.

**2.3. Methods**

This section describes the research methods adopted in this dissertation. It discusses the research design as well as the strategies used to gather data and the data analysis process that was undertaken.

Ethics approval for the following studies was obtained from the University of Toronto Health Sciences Research Ethics Board, and as some of the data was collected at international locations local ethics was sought at the closest University. The local University Ethics Board in Melbourne and Lisbon deemed that the study did not require additional ethics. Ethical approval was gained from LaSalle University in Madrid, Protocol Reference Number CSEULS-PI-
057/2015 and from Spedali-Civili – Brescia, Comitato Etico Provinciale, Provincia di Brescia Protocol Reference Number TOR2014 for the data collection that occurred in Madrid and Brescia respectively.

2.3.1. Modified e-Delphi

This study was designed to gain consensus within the international expert Bobath association (IBITA) on a Bobath clinical framework. The Delphi is defined as an iterative process designed to combine expert opinion into group consensus (Keeney, Hasson, & McKenna, 2001). It is a technique that elicits, refines and draws upon the collective opinion and expertise of a panel of experts using a series of intensive questionnaires interspersed with controlled opinion feedback (Gupta & Clarke, 1996). The Delphi is a popular research method that has been successfully used in the allied health professions with large numbers of experts across diverse locations (Mackway-Jones & Carley, 2012); (Manca et al., 2007). The Delphi method had been successfully used previously with Bobath experts to identify the theoretical assumptions underpinning the contemporary Bobath concept, but was limited to one country group, the UK (Raine, 2006); (Raine, 2007b). However, the Delphi method is juxtaposed between quantitative and qualitative paradigms, therefore in order to establish rigour specific aspects of the study design required careful consideration such as defining the expert group, the use of a preliminary framework, establishing consensus a priori, analytical transparency and the inclusion of a study auditor (Hasson & Keeney, 2011); (Geist, 2010); (Keeney et al., 2001); (Hasson, Keeney, & McKenna, 2000); (Gupta & Clarke, 1996); (Williams & Webb, 1994); (Judd, 1972).

The International Bobath Instructors Training Association (IBITA) is the internationally recognized expert Bobath association requiring specific training and membership requirements. IBITA therefore provided a clearly defined expert group as the study sample. All full members of IBITA, those members who are actively practicing and teaching the Bobath concept, were invited to participate in Round One. The Round One respondents formed the Delphi panel and invites for subsequent Rounds were only sent to the Delphi panel. The formation of the Delphi panel following Round One was to minimize attrition on successive Rounds (Geist, 2010).

A web-based Delphi was chosen to remove geographical challenges and time boundaries enabling an international expert group to be surveyed inexpensively, quickly but broadly (Hasson & Keeney, 2011). A secure study website was developed to ensure only IBITA
members accessed the questionnaires. All study information, questionnaires and reports were located on this website in the event that an IBITA member missed a Round but wanted to join a subsequent Round.

A classic Delphi Round One consists of open-ended questions stimulating a brainstorming session. However, a preliminary Bobath clinical framework identifying six assumptions and seventeen principles had been developed through this authors Masters study (Vaughan-Graham, 2010). In addition six key aspects of Bobath clinical practice and three statements identifying theoretical foundations had also been identified through a Scoping Study by this author (Vaughan-Graham et al., 2015b). Therefore, these statements formed the basis of Round One potentially reducing the number of rounds and researcher bias. Each statement was accompanied by a comment box in addition to the 5-point Likert scale providing opportunity for the respondents to enter their thoughts and suggestions with respect to alternative wording, additional statements, or for them to indicate if they felt a statement should be removed.

Consensus was defined a priori as at least 80% of respondents ranking 4 or 5 for a statement for all Rounds (Williams & Webb, 1994). Qualitative comments were collected for each statement and underwent content analysis by this author (Hsieh & Shannon, 2005). All statement revision, generation and elimination were verified by a study auditor. Respondents had the option to download their questionnaire responses, and reports for each Round providing aggregate data were posted on the study website.

In total, this Delphi process involved three Rounds of questionnaires achieving consensus on eight statements representative of the conceptual framework underpinning Bobath clinical interventions, and three key assumptions with an accompanying eight principles identified as representing key aspects of Bobath clinical practice. The results from this study fill a significant gap in the Bobath evidence base with respect to contemporary clinical practice and formed the foundation on which to base further study of expert Bobath therapist’s conceptualization of movement and clinical reasoning process.

2.3.2. A Qualitative Research Approach using Interpretive Description Methodology

This study was completed as part of a larger program of research investigating the clinical reasoning process and interventions used by expert Bobath therapists. The findings presented in
this dissertation address research objective two and three and illustrate how expert Bobath therapists conceptualize movement and the role of professional practice knowledge in the clinical reasoning process.

A qualitative approach was undertaken for this study to enable the discovery, description and exploration of human behavior (Carpenter & Suto, 2008)(p.98). ‘Interpretive Description’ is a qualitative methodology utilized to generate credible and meaningful disciplinary knowledge in the applied sciences, by seeking to gain understandings of a clinical phenomena of which a clinical useful theoretical abstraction can be developed (S Thorne, Kirkham, & MacDonald-Emes, 1997);(Sally Thorne, Reimer Kirkham, & O'Flynn-Magee, 2004). The research aim through Interpretive Description is to advance the understanding of experiential, tacit knowledge within the health sciences through the application of specific methods (Sally Thorne, 2008)(p.23-51). Interpretive methods take into consideration the social and environmental contexts enabling the investigation of complex processes within the practice context (Carrier et al., 2010) and draws upon an inductive reasoning approach (Sally Thorne et al., 2004).

The Full members of IBITA formed the study sample and were recruited through the IBITA country representatives, this ensured member participation from different countries. In addition, different instructor levels were also sought to ensure a broad range of views were incorporated thereby reflecting the breadth of the IBITA membership.

This study utilized non-participant observation through the use of video recording of one clinical session per participant, maximum 1.5 hours duration. The video session was immediately followed by a video-recorded, in-depth focused interview of the participant, whilst reviewing the video of their clinical session. This is referred to as ‘stimulated recall’ (Norman, 2005) in the field, to facilitate the articulation of the clinical reasoning process by the participant as closely as possible to how it occurred. Review of the video recording also facilitated the participant to articulate the non-verbal communication occurring within the clinical session, thereby seeking to explore the depth of tacit knowledge beyond verbal communication.

The interview transcripts were transcribed verbatim by this author forming the raw data and were imported into the NVivo qualitative software program. Data analysis commenced with line by line coding where segments of the data were labeled as close to the actual data. Data analysis progressed as codes were compared within a transcript and between transcripts such that codes
were grouped and re-labeled forming categories. The data analysis process was progressive and iterative, and included the writing of memo’s providing an audit trail of the researchers decision-making process. Through the data analysis process the codes and categories were taken to successive levels of interpretation forming over-arching themes providing an abstract representation of the data. To ensure the trustworthiness of the data, a code book was developed such that all codes, categories and themes were identified with participant data.

To explicate a conceptual understanding of movement, addressing Research Objective Two, Figure 2-1 (p.24) provides an overview of the data analysis process illustrating the findings resulting in the development of the theme, ‘Integration of Postural Control and Selective Movement’. The study findings are the first of their kind presenting empirical data illustrating the conceptualization of movement by expert Bobath therapists. Previous publications on physiotherapy theories of movement have been theoretical and therefore may have limited clinical utility or are situated primarily as grand theories (Hislop, 1975);(C. A. Cott et al., 1995);(Sahrmann, 2014). Three key elements were identified within the therapists’ conceptualization of movement, each of which is compatible with the Bobath clinical framework identified through the Delphi study.

To explicate the clinical reasoning process, addressing Research Objective Three, Figure 2-2 (p.25) provides an overview of the data analysis process illustrating the findings resulting in the development of the theme ‘Person Centred’. As the coding and analysis process progressed it became apparent that one of the themes was congruent with the Bobath clinical framework identified in the Delphi study. The study findings identified three themes, ‘Person-Centred’, ‘Bobath Clinical Framework’, and a ‘Bobath Reasoning Approach’ explicating the expert Bobath therapists’ clinical reasoning process. The findings of this study are consistent with previous clinical reasoning literature but highlight the role of professional practice knowledge, practical wisdom or phronesis, specifically visuo-spatial kinesthetic skills, as an essential aspect of expert Bobath therapist’s clinical reasoning process.

2.4. Summary

This chapter provides disclosure of the author’s situation with respect to the research, identifying the discipline specific knowledge required to undertake a study utilizing Interpretive Description
methods. In addition, this chapter summarizes the research aims, objectives and provides an overview of the methods involved in this dissertation. The following Chapters will reiterate and elaborate on the methods discussed in this chapter.

Chapter Three will detail the e-Delphi study presenting the manuscript accepted for publication in the peer-review journal Physiotherapy Theory and Practice. Chapter Four will detail the study using Interpretive Description methodology presenting a prepared manuscript providing a full account of the study design, procedure, data collection process, and analysis and will present the findings with respect to the conceptualization of movement. Chapter Five, also a prepared manuscript, will present the findings from the Interpretive Description study with respect to the clinical reasoning process. The study design, procedure, methods etc. will not be fully reiterated in Chapter Five but will be summarized accordingly.
Figure 2-1 Development of the Theme - Integration of Postural Control and Selective Movement
Figure 2-2 Development of the Theme - Person Centred
3.1. Introduction

Neurological conditions have significant personal, financial and economic costs. Stroke, for example, is a major global health problem in terms of disability and socioeconomic burden that will increase as the population ages (Wissel et al., 2013). Therefore access to effective and efficient neuro-rehabilitation services across the continuum of care is essential in order to optimize recovery and minimize disability (Duncan et al., 2002). The Bobath concept, referred to as ‘Neuro-Developmental Treatment (NDT)’ in the American literature, is one of the most widely used approaches by therapists in neuro-rehabilitation (Vaughan-Graham et al., 2015a). However due to significant limitations in the evidence base, in particular study fidelity issues (Vaughan-Graham et al., 2015b), the Bobath effectiveness literature is inconclusive (Kollen et al., 2009).

The operationalization and description of interventions, an aspect of study fidelity on which causality is dependent, has been identified as one of the major limitations in neuro-rehabilitation research (Page et al., 2012);(Hart & Bagiella, 2012);(Hildebrand et al., 2012). Additionally, operationalization and description of interventions is essential for clinical replication as well as inclusion in quality systematic reviews and meta-analyses (Boutron et al., 2008). A recent scoping review of the Bobath (NDT) evidence base identified revised theoretical foundations and key aspects of clinical practice (Vaughan-Graham et al., 2015a). However, no clear descriptions of Bobath clinical practice have been produced to date (Vaughan-Graham et al., 2015a). Therefore establishing a Bobath clinical framework, identifying the assumptions and principles that underpin Bobath clinical practice as a first step in the operationalization of Bobath treatments is required (Vaughan-Graham et al., 2015a).
3.2. Background

The Bobath concept is an approach to neuro-rehabilitation providing therapists with a conceptual framework for their clinical interventions (Raine, Meadows, & Lynch-Ellerington, 2009). Mrs. Bobath qualified as a physiotherapist in 1950 from the Chartered Society of Physiotherapists, UK (Schleichkorn, 1992) at a time when conventional treatment post-stroke consisted of a ‘compensatory’ approach focusing entirely on the use and strengthening of the ‘sound’ side to regain functional independence (Bobath, 1978);(Raine et al., 2009). Mrs. Bobath recognized that movement post-neurological lesion was influenced by afferent input and she began to explore the ‘recovery potential’ of the ‘affected’ side despite no clinical evidence at the time for neuroplasticity and clearly deviating from the conventional compensatory approach (Schleichkorn, 1992);(Bobath, 1978);(Raine et al., 2009). This was the beginning of a new treatment approach to adult hemiplegia (Schleichkorn, 1992), and revolutionized neuro-rehabilitation (Raine, 2007b).

Since Mrs. Bobath’s last publication in 1990 (Bobath, 1990) until 2006 peer-reviewed documentation on the evolvement of the concept has primarily been undertaken with practicing therapists with varying Bobath knowledge and skill levels gained through their professional practice and post-graduate Bobath education (S Lennon, 1996);(S Lennon & Ashburn, 2000);(S Lennon et al., 2001);(Sheila Lennon, 2001);(SF Tyson & Selley, 2007);(SF Tyson, Connell, Busse, & Lennon, 2009);(Vaughan-Graham et al., 2015a). The International Bobath Instructors Training Association (IBITA) is responsible for the training of Bobath instructors worldwide and endorsing Bobath continuing education courses disseminated by IBITA instructors.

IBITA was founded by a small group of Bobath (Adult) instructors with the Bobath’s in 1984 to enable the ongoing interaction of current instructors and training of future instructors. IBITA is the international expert Bobath association representing upwards of 250 members in 29 countries worldwide. Since 2006 there have been four peer-reviewed publications authored and co-authored by members of the IBITA addressing theoretical aspects. Firstly Raine, utilizing British members of the IBITA, conducted a Delphi study (Raine, 2006);(Raine, 2007b) to identify the theoretical assumptions underpinning the contemporary Bobath concept. However, these expert Bobath instructors belonged to one country group, the UK (Raine, 2006);(Raine, 2007b) thus limiting the generalizability of the results to the IBITA. VGraham et al. (2009)
published a revised theoretical framework based on contemporary neuroscience and neurorehabilitation, as well as identifying key aspects of Bobath clinical practice. Lastly, Levin and Panturin (2011) focused their publication on a key principle of the Bobath concept, the role of sensory information in motor control.

Although key aspects of clinical practice were identified in a recent scoping review of the Bobath evidence base 2007-2012, no clear descriptions of Bobath interventions were available and only one publication addressed the issue of clinical reasoning (Vaughan-Graham et al., 2015a);( Vaughan-Graham et al., 2015b);(Vaughan-Graham, 2010). Practice epistemology has been described as the approach that clinicians take towards knowledge that frames their approach to decision-making and care (Shaw & DeForge, 2012). Practice epistemologies remain under-researched in the therapy professions (Shaw & DeForge, 2012), the Bobath concept is no exception. Models or frameworks explicate the clinical rationale underlying the choice of intervention therefore providing an understanding of the intervention content (SF Tyson & Desouza, 2003). Unless models or frameworks that are reflective of current clinical practice guide research design and implementation misrepresentation of treatment approaches may be inadvertently reinforced (Vaughan-Graham et al., 2015b).

Little to no attention has been given to the development of a Bobath clinical framework explicating the assumptions and principles the Bobath therapist holds with respect to movement analysis, problem identification and recovery potential of an individual with a neurological diagnosis. In order for the Bobath concept to be appropriately researched it is essential that a Bobath clinical framework be established to facilitate the description of Bobath interventions and to provide a conceptual underpinning to the clinical reasoning process (Pomeroy & Tallis, 2003);(Wang, Olson, Campbell, Hanten, & Gleeson, 2003). To date no studies involving IBITA members worldwide have been undertaken to document the theoretical and clinical evolvement of the Bobath concept.

The aim of the present study was to gain consensus within the IBITA on a Bobath clinical framework on which future efficacy studies can be based.
3.3. Study Design

The Delphi is a popular research method that has been successfully used in the allied health professions with large numbers of experts across diverse locations (Mackway-Jones & Carley, 2012); (Manca et al., 2007); (Yeung, Woods, Dubrowski, Hodges, & Carnahan, 2015). The Delphi has been defined as an iterative process designed to combine expert opinion into group consensus (Keeney et al., 2001). Expert opinion is elicited and refined using a series of questionnaires interspersed with controlled opinion feedback (Gupta & Clarke, 1996). Establishing a panel of experts is an important aspect of the Delphi study design aiming to maintain member participation in subsequent survey rounds (Hasson et al., 2000). The Delphi has been used successfully in a previous Bobath consensus study (Raine, 2006); (Raine, 2007b), but as noted earlier, the expert sample was limited to the British members of IBITA.

The study design utilized a three-round web-based modified e-Delphi approach. A secure study website was developed where all study information and study access to all Delphi questionnaires and reports were located. This removed geographic challenges and time boundaries whilst allowing an international expert group to be surveyed relatively inexpensively, quickly but broadly (Hasson & Keeney, 2011). All study information including the Delphi questionnaires and summary reports were presented in English as this is the designated correspondence language for IBITA.

Ethical approval was granted for this study from the Health Sciences Research Ethics Board, University of Toronto (Protocol Reference # 29915).

3.3.1. Development of the Questionnaire

Round one comprised twenty-one statements, rather than open-ended questions, as per a modified Delphi procedure (Hasson et al., 2000); (Hasson & Keeney, 2011). These statements were identified from a recent scoping review of the Bobath literature conducted by the first author and were representative of the theoretical foundations and key aspects of clinical practice over the period 2007-2012 (Vaughan-Graham et al., 2015b). Seven statements represented overarching conceptual aspects whilst fourteen statements represented key aspects of clinical practice and were organized as 4 assumptions and 10 related principles (Table 3-2 Round One Initial Statements p.45).
The respondents in all three survey rounds were asked to rank their level of agreement with each statement on a 5 point Likert scale ranging from ‘strongly disagree’ to ‘strongly agree’. Each participant was asked to complete demographic information on completion of the survey identifying their instructor category and if English was their second language to determine the range in IBITA member participation (Table 3-1 Respondent and Statement Summary p.44).

A comment box was provided after each statement to collect respondent’s qualitative comments to allow for the identification of any missed items requiring generation of additional statements, as well as suggestions for alternative wording. This is an important aspect of the Delphi design to increase respondent ownership (Hasson et al., 2000). All respondents provided comments and suggestions during all three Delphi Rounds irrespective of whether English was their second language.

Pilot testing of the initial questionnaire and study website was undertaken with a group of seven Bobath trained physiotherapists and was revised accordingly based on feedback.

3.3.2. Sampling and Recruitment

IBITA unites approximately 265 Bobath instructors in 29 countries worldwide, with three member categories, full, associate and retired. Full members are those members who are currently practicing and instructing the Bobath concept worldwide in the context of continuing education courses and fulfill specific membership requirements. There are three instructor categories of ‘full’ members, senior, advanced and basic. Two hundred and four IBITA ‘full’ members were identified comprising thirteen senior instructors, twenty-eight advanced course instructors and one hundred and sixty-three basic course instructors. The inclusion of all full member instructor categories provided a range in Bobath instructor experience.

Access to the ‘full’ members of IBITA was negotiated by the first author through the IBITA Executive committee. Recruitment occurred via email invitation from the Chair of the IBITA Executive committee to the membership requesting their voluntary participation. All study details were provided with the initial email invitation, followed by a reminder one week later. Study information was also posted on the members’ side of the IBITA website. Responses were handled confidentially by the first author through the study website, therefore participants were unknown to the IBITA Executive Committee. Those ‘full’ members who responded to the initial
email invitation formed the ‘Delphi panel’. Only the ‘Delphi panel’ received subsequent email reminders and notices for Rounds Two and Three.

3.3.3. Study Procedure

A password protected study website was used to ensure secure access for invited full members of IBITA. The website presented in English the study description, ethical and contact information, calendar of events, informed consent, access to each questionnaire and respective reports. The Delphi questionnaires, including demographic questionnaires, were password protected. Respondents could not access other participant’s responses. The Delphi questionnaire for each round was available online for two weeks. Email reminders were sent at one week, and two days prior to the questionnaire deadline. Summary reports for each round and subsequent questionnaires were posted online within four weeks of the previous round (Figure 3-1 Delphi Study Procedure p.43).

3.3.4. Feedback to Respondents

Each respondent had the option to save their completed responses as a function of the survey software (FluidSurveys™). A report was posted to the study website following each round providing number of respondents, Likert scale response frequency (%), consensus score for each statement and respondent aggregate data.

3.4. Analysis of Data

Responses were exported to MS Excel and descriptive statistics including central tendencies (mode, median, mean), level of dispersion (coefficient of variation), Likert frequency scores (%) and consensus score (%) were reported for each survey item within each round. Consensus was defined a priori as at least 80% of respondents ranking 4 or 5 for a statement. Qualitative comments were collected for each statement and underwent content analysis by the first author (Hsieh & Shannon, 2005). Similar issues were grouped together in order to identify consistent themes and these were then used to revise, re-order and generate new statements whilst aiming to use the wording of the respondents as closely as possible. Three new statements (items 5 a)(i) b)(i) – Table 3-3 Round Two p.47) were generated following Round One and were therefore only considered in Rounds Two and Three. Statements that produced significant discussion were identified and informal literature review was used to facilitate structured debate around specific
issues (Hasson et al., 2000). The first and second author met after each round of data collection to discuss the analysis and plan the next round.

3.5. Results

3.5.1. Round One

Eighty-nine out of 204 ‘full’ members (44%) responded to the initial invitation. Sixty-one members identified as English as a second language (ESL). An additional five members emailed the first author following Round One specifically requesting to participate identifying that they were unable to participate in Round One due to teaching commitments or internet access difficulties. This study sought to be as inclusive as possible of all IBITA ‘Full’ members and none of the additional five members identified any concerns with the summary report of Round One. Therefore, the first and second author agreed to include any ‘Full’ member who requested to participate after the initial invitation. Therefore, the initial 89 respondents, plus the additional 5 members, formed the ‘Delphi panel’ (Table 3-1 Respondent and Statement Summary p.44).

One over-arching statement (item 5 - Table 3-2 Round One Initial Statements p.45) discussing the role of compensatory strategies in function (78.4%), and three statements with respect to key aspects of clinical practice discussing the interactive nature of posture and movement (73.9%) (item b)(i) - Table 3-2 Round One Initial Statements p.45), and movement quality (78%) (items d)(i)(ii) - Table 3-2 Round One Initial Statements p.45) did not reach consensus.

There was a lively debate in the open-ended comments around the role of compensation in functional independence. Several respondents commented that the Bobath concept does not focus on teaching stereotypical compensatory strategies (e.g., emphasizing use of the less affected limbs) but that compensatory strategies should complement the ongoing recovery of motor control but not interfere with it. For example, the use of a cane to enable community ambulation rather than self-propelling a wheelchair. Many of the respondents stated that it was a role of the Bobath therapist to manage compensatory strategies. As one respondent states:

“We are not focused on compensatory training, but if necessary we help develop compensatory strategies that minimize the development of secondary impairments for long term functional performance”.
Respondents agreed that posture and movement, and movement quality were key features of the Bobath concept. One respondent commented:

“Posture and movement are separate in terms of systems (neurophysiology). However, Berta and Karel Bobath said in the last edition of their book, “Thinking of posture as separate from movement is very artificial”’.

Numerous rewording suggestions were provided by participants for these statements (refer to items 9, 10, 11, a) - Table 3-3 Round Two p.47).

One statement discussing the interplay of speed or repetition on movement quality was eliminated (61.6%) (item d)(ii) - Table 3-2 Round One Initial Statements p.45) in Round One due to consistent comments received that this statement did not reflect actual Bobath practice. One respondent stated:

“I think the quality of movement will deteriorate when the difficulty increases BUT one must challenge the system and keep facilitating until the quality of movement recovers…which it will!”

Although the remainder of the statements reached consensus the respondents provided thoughtful and consistent suggestions for all statements to improve statement clarity, as well as suggesting the inclusion of a statement with respect to balance (item 5 - Table 3-3 Round Two p.47) in addition to postural control (item 6 - Table 3-3 Round Two p.47). In response to suggestions all statements were revised, in some cases re-ordered, a new statement with respect to balance (item 5 – Table 3-3 Round Two p.47), and two new statements with respect to quality of movement were introduced in Round Two (items a)(i), b)(i) – Table 3-3 Round Two p.47).

3.5.2. Round Two

Sixty-eight members of the 94 respondents (72%) forming the Delphi panel responded to Round Two of whom 48 were ESL (Table 3-1 Respondent and Statement Summary p.44). Round Two comprised of twenty-two statements. Eleven statements were presented as providing the conceptual framework on which a Bobath therapist bases clinical interventions of which six statements were revised from Round One (items 1 2 3 7 8 10 – Table 3-3 Round Two p.47), four statements were revised and re-ordered (items 4 6 9 11 – Table 3-3 Round Two p.47), and one
new statement with respect to balance (items 5 – Table 3-3 Round Two p.47). The remaining eleven statements represented key aspects of clinical practice organized as three assumptions (items a) b) c)) and eight related principles (a(i)(ii)(iii) b(i)(ii)(iii) c(i)(ii)). Nine of these statements were revised (items a) a)(ii) a)(iii) b) b)(ii) b)(iii) c) c)(i) c)(ii) – Table 3-3 Round Two p.47) and two were new statements (items a)(i) b)(i) – Table 3-3 Round Two p.47). Although the two principles (items a)(i) b)(i) - Table 3-3 Round Two p.47) were only introduced in Round Two they both received high consensus scores, 97% and 100% respectively, and so were accepted in this Round (Table 3-3 Round Two p.47).

Consensus was reached in Round Two on two fundamental components: (1) the theoretical underpinnings of the Bobath concept are consistent with the current literature on the Bobath theoretical assumptions represented by item #3 (Table 3-3 Round Two p.47) achieving a consensus score of 94%. It states: ‘The Bobath concept is informed by contemporary theories of motor control, neuromuscular plasticity, biomechanics and motor learning providing the theoretical basis for the interpretation of posture, functional human movement analysis and recovery post CNS lesion’; and, (2) that the Bobath concept considers the whole person within their individual context represented by item #7 (Table 3-3 Round Two p.47) achieving a consensus score of 94%. It states: ‘The Bobath concept is based on the understanding that neurological pathology affects the whole person and the resulting movement problems are influenced by that person’s lived experiences pre and post the neurological lesion’.

Two statements did not reach consensus (items 9 10 – Table 3-3 Round Two p.47), and were related to the discussion of ‘atypical motor behavior’ (61.2%) and ‘compensation’ (53%).

All three assumptions and eight principles related to key aspects of clinical practice reached consensus, of which six (items a)(i) a)(ii) a)(iii) b) b)(i), c)(ii) – Table 3-3 Round Two p.47) received minimal comments, achieved high levels of consensus and were therefore accepted in this round (Table 3-3 Round Two p.47).

In Round Two, two primary areas of discussion emerged from the respondent’s comments: 1) atypical motor behavior and compensation; and 2) balance.
### 3.5.2.1. Atypical motor behavior and compensation

Respondents had difficulty limiting the description of atypical motor behavior to the more affected limb/s and body segments as well as the use of the terms ‘inefficient and invariable’.

One respondent commented:

“If atypical motor behavior, because of the extent of the lesion, allows the individual to be active and independent, it may be ‘efficient’ for that person. Sometimes the damage does not allow for more ‘efficient’ movement”.

Whilst another respondent commented:

“I would change invariable for stereotyped, since typical motor behavior can be quite invariable sometimes.”

Another respondent stated:

“Not only the affected limbs … a unique aspect of the Bobath concept is the consideration of the whole body and analysis of movement of the whole body”.

To facilitate an informed and structured debate in Round Three clarification was provided on the terminology ‘compensation’ and ‘atypical’ from the literature.

<table>
<thead>
<tr>
<th>Bobath (1978) p.17 states:</th>
<th>“…how much of any activity is done with the affected side; of whether trick or abnormal movements are used, or the extent to which the sound side is compensating for the affected side”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bobath (1978) p.21 states:</td>
<td>“One should find out how much he compensates with his sound side; whether he really needs as much compensation as he uses; whether he could learn to compensate less or in better ways”</td>
</tr>
</tbody>
</table>
Levin et al. (2009) defines compensation at the activity level as:

“Successful task accomplishment using alternate limbs or end effectors. For example opening a package of chips using 1 hand and the mouth instead of 2 hands”

Respondents were asked to consider this information before responding to a revised statement in Round Three (item 11 – Table 3-4 Round Three p.52).

3.5.2.2. Balance

The statement with respect to balance (item 5 – Table 3-3 Round Two p.47) generated a wide range of views. For some respondents the statement was too broad, for others it was too narrow, others commented that it should be defined by the (neuro)science as it is common to all rehabilitation whereas others responded that balance is fundamental to the Bobath concept. Based on respondent's feedback the balance statement underwent minor wording revisions and was re-presented in Round Three (item 5 – Table 3-4 Round Three p.52). In response to the wide range of views expressed, and that this statement was introduced in Round Two, respondents were asked in Round Three to rate their level of agreement with the balance statement plus vote on whether the statement should be included in a Bobath clinical framework.

In summary, in Round Two nineteen statements underwent wording revisions based on feedback, three new statements were introduced, eight statements were accepted and two statements were eliminated.

3.5.3. Round Three

Round Three consisted of the twelve revised statements from Round Two. Seven statements (items 1 2 4 5 6 8 11 – Table 3-4 Round Three p.52) were presented as providing the conceptual framework on which a Bobath therapist bases clinical interventions. The remaining five statements were presented as two assumptions (items a) c) - Table 3-4 Round Three p.52) and three principles (items b)(ii) b)(iii) c)(i) – Table 3-4 Round Three p.52) representing key aspects of clinical practice. Sixty-six members of the 94 respondents (70%) forming the Delphi panel responded to Round Three of whom 47 were ESL.

All statements reached consensus, including the statement with respect to balance. However, when respondents were asked to vote on whether the balance statement should be included in a
Bobath clinical framework, only 75% responded ‘yes’. Therefore, although agreement was reached on a balance statement this statement did not reach consensus to be included in the clinical framework (item 5 - Table 3-4 Round Three p.52).

The majority of comments continued to focus around the issues of compensation, atypical motor behavior and balance, however all statements achieved a high level of consensus and were therefore accepted in this round (Table 3-5 p.54 – Statements representative of the conceptual framework underpinning Bobath clinical interventions, and Table 3-6 p.56 – Statements representing key aspects of Bobath clinical practice).

### 3.6. Discussion

This study is the first of its kind to seek consensus from international expert members of IBITA with respect to a Bobath clinical framework. A satisfactory response rate for Round One, that was maintained for Round Two and Three, were achieved. IBITA members for whom English was a second language responded consistently through all three Delphi rounds, indicating that the developed framework was not dominated by members for whom English was their first language. The high level of consensus, and small coefficient of variation reported on a per item basis through all three rounds indicates that the amount of variation among the responses of the experts was generally small (Kalaian & Kasim, 2012)(Tables 3-2 p.45, 3-3 p.47, and 3-4 p.52). The present study did not either encourage or attempt to control communication between IBITA members in the periods between the study rounds. However, the thoughtful and consistent comments received with respect to all statements resulted in subtle changes to the wording and therefore subsequent meaning thus facilitating consensus.

#### 3.6.1. Statements representative of the conceptual framework underpinning Bobath clinical interventions

The members of the international expert Bobath association agree that the Bobath concept is now: founded on a systems based model of motor control; no longer subscribes to a hierarchical control model; and, that the individuality of movement dysfunction is critical to the application of the Bobath concept. The experts were also in agreement that the Bobath concept is an individualized problem-solving treatment concept, can be applied to a broad range of clients, and is not exclusive of other interventions (Table 3-5 p.54).
Mrs. Bobath recognized and understood that posture and movement were not separate entities (Bobath, 1978). This is now supported by increasing scientific knowledge on ‘Early Postural Adjustments (EPA’s)’, ‘Anticipatory Postural Adjustments (APA’s)’ and Compensatory Postural Adjustments (CPA’s) (Lee & Aruin, 2013); (Mohapatra, Krishnan, & Aruin, 2012). Consensus was achieved on a unique aspect of the concept, movement analysis with respect to postural control, stating: “Within the Bobath concept, postural control is viewed as the organization of stability, mobility and orientation of the multi-joint kinetic chain, which is reflective of the individual’s body schema in order to maintain, achieve or restore a state of equilibrium during any posture or activity”. Thus the Bobath therapist throughout movement analysis is at all times considering sensory integration, postural control and selective movement of the individual. For example, the clinical question may be, “Can this person not perform this activity due to a loss of specific selective movement, body schema, and/or because they have insufficient postural control on which to base selective movement?”

For neurorehabilitation research to be clinically applicable, and for clinical practice to be replicable, a shared understanding of specific terminology with respect to the clinical presentation is essential. Although the Bobath experts agreed on the statement describing ‘typical motor behavior’ as representative of the range of motor behavior available to individuals without a central nervous system (CNS) lesion, there was considerable discussion with respect to the statements describing motor behavior post CNS lesion, as well as which motor behavior should be the focus of intervention, recovery or compensation. Although some discussion of the terms ‘recovery’ and ‘compensation’ has occurred in the literature (Mindy F Levin, Kleim, & Wolf, 2009), clear descriptions of motor behavior post CNS lesion are lacking. Additionally, how a therapist understands and describes motor behavior is reflective of their theoretical framework and underpins their clinical reasoning (SF Tyson & Desouza, 2003). The neurorehabilitation research to date categorizes clients by their medical diagnosis (Kollen et al., 2009), whereas clinical neurological rehabilitation addresses the movement problems that arise from the underlying medical diagnosis. Clearer descriptions and categorization of movement problems have the potential to enhance the clinical relevance of neurorehabilitation research.

In Round Two the lack of agreement with the statement with respect to compensation (item 10 – Table 3-3 p.47)(53%) may have been due to either the description of compensatory movement or whether compensation is a primary focus of treatment using the Bobath concept. Likewise lack
of agreement with the statement with respect to ‘atypical motor behaviour’ (item 9 – Table 3-3 p.47) may have been due to the movement descriptors and/or reference to the more affected body segments/limbs. An associated statement on optimizing functional independence by potentiating typical motor behavior while minimizing atypical and compensatory motor behavior did reach consensus (item 11 – Table 3-3 p.47)(91%).

Mrs. Bobath used the terminology normal, abnormal and compensation to describe the clinical presentation throughout her publications (Bobath, 1970);(Bobath, 1978);(Bobath, 1990). Today it is recognized that there is no ‘normal’ movement, but a range of typical motor behavior (i.e., similar characteristics of age and gender-matched motor behavior) (M F Levin & Panturin, 2011). In contrast those persons who present with dissimilar movement characteristics, or, atypical motor behavior, are no longer referred to as having ‘abnormal’ movement. Expert consensus was gained on the movement descriptors: compensation (use of less affected body segments/limbs to perform a task); and, atypical motor behavior (movement of the more affected body segments/limbs), with respect to optimizing functional independence context-based to the individual. For example, should the therapist address the compensatory movement of the less affected body segment/limbs as this is contributing to the learned non-use of the more affected body segments/limbs? Or, should the therapist address the atypical movement of the more affected shoulder girdle as this is negatively impacting on the development of the reach pattern of the more affected upper limb? Or, are both scenarios occurring simultaneously?

Lastly, it would seem that the variability in the experts opinions with respect to balance are reflected in the literature as balance definitions vary widely (M. Mancini & Horak, 2010) (SF Tyson & Connell, 2009). Although the balance statement reached consensus in Round Three, the experts agreed that this statement should remain within the domain of neuroscience for its definition as it is common to all rehabilitation. It is how the therapist interprets balance within the context of motor recovery post CNS lesion that makes it specific to a particular concept. Further discussion and investigation of how balance is viewed, interpreted and clinically applied within the Bobath concept is required.

3.6.2. Statements representative of key aspects of Bobath clinical practice

Through the process of consensus building with expert Bobath clinicians, the key aspects of Bobath clinical practice became focused into three primary areas: (a) movement analysis of task
performance; (b) the interdependence of posture and movement; and, (c) the role of sensory information in motor control all of which are reflected in the consensus statements representative of the conceptual framework (Table 3-6 p.56).

The Bobath experts agreed that task selection is individualized and specifically chosen to optimize postural control and selective movement, and that aspects such as ease, rhythm, coordination, specificity, variability, repeatability and speed all should be addressed and evaluated in task performance. This is in contrast to treatment approaches such as the Motor Relearning Program (Langhammer & Stanghelle, 2011) or Task Specific Training (Arya et al., 2012) where task completion is the goal of intervention rather than task performance. Since its inception the Bobath concept has always been concerned with ‘how’ a client performs a task, the quality of task performance. Mrs. Bobath recognized that assessment of functional ability is limited by its quantitative nature as it does not provide any information about the quality of improvement of function, specifically how the activity was performed such as how much movement of the affected side was used, how atypical was this movement, or how much compensatory movement of the less affected side was used (Bobath, 1978). Unfortunately the focus of neurorehabilitation continues to be primarily on task accomplishment, also the basis of the majority of outcome measures, where the differentiation between compensation, typical and atypical motor behavior is lacking (Mindy F Levin et al., 2009);(Harkema, Schmidt-Read, Lorenz, Edgerton, & Behrman, 2012) e.g., walking faster is not necessarily the same as walking ‘better’ (Tansey, McKay, & Kakulas, 2012). The challenge for those in neurorehabilitation practice and research is how to quantify these qualitative aspects of movement in order for effectiveness research to be more clinically relevant.

Consideration of the whole person including their lived experiences pre and post a central nervous system (CNS) lesion within the Bobath concept is in contrast to some treatment interventions that consider one aspect of the individual such as Constraint Induced Movement Therapy (CIMT) for upper limb recovery and Body-Weight Support Treadmill training (BWST) for recovery of locomotion. Whilst these interventions are based on current neuroscience and recovery mechanisms post CNS lesion they fail to recognize the role of the trunk, head and posture in motor control, and more importantly the role of the person in functional recovery. Perhaps the lack of consideration of reach to grasp and walking as whole person activities, and thus requiring the integration of posture and movement, may be one reason why BWST training
has had difficulty demonstrating clinical effectiveness (Dobkin & Duncan, 2012) or the integration of CIMT into routine clinical practice has been problematic (Viana & Teasell, 2012).

The role of sensory information in motor control and perception has been a core tenet of the Bobath concept since its inception, and remains so today (Vaughan-Graham et al., 2015a). Understanding the interaction between the client’s body segments, supporting surface and gravity was identified as a fundamental clinical principle by the experts providing critical information on the client’s perceptual abilities as well as their ability to generate appropriate postural control. Mrs. Bobath recognized she could influence a client’s movement through her handling, namely facilitation, and that facilitation was a skill stating:

“... it may not necessarily be the technique or the pattern which is unsuitable, it may be the way it is used which fails to produce the desired response” (Bobath, 1978)(p.64).

Facilitation, or therapeutic handling, are clinical skills the therapist develops including manipulation of the environment and somatosensory information, task selection part or whole, as well as verbal cues to optimize the client’s movement experience. Facilitation is a skill acquired through reflective professional practice, but unfortunately it is an aspect of clinical practice that has received little attention to date (Nicholls & Holmes, 2012);(Vaughan-Graham et al., 2015a). This is compounded by poor attention to methodologic aspects of experimental study designs such as intervention description, therapist adherence and expertise on which causality determinations are dependent (Boutron et al., 2008);(Hart & Bagiella, 2012);(Hildebrand et al., 2012);(Vaughan-Graham et al., 2015b), despite the introduction of mandatory use of reporting guidelines to improve rehabilitation research quality (Chan et al., 2014). Even though on the ground all clinicians know that to optimize a client’s recovery post neurological lesion a good physiotherapist is key, the value of the art of neurorehabilitation, and physiotherapy professional practice as a whole, is yet to be realized (Tansey et al., 2012);(Nicholls & Holmes, 2012);(Vaughan-Graham et al., 2015b).

3.7. Conclusions

Using a Three Round secure web-based survey the Delphi technique was successfully used to gain consensus in a geographically disperse expert association (IBITA). All statements went through a process of rewording and re-ordering to gain consensus of the Bobath experts. Eight
statements gained consensus of being representative of the conceptual framework underpinning Bobath clinical interventions (Table 3-5 p.54). Through structured debate consensus was gained on movement descriptors, typical, atypical and compensatory, which will assist in clarifying client’s movement problems. Further investigation is required with respect to how ‘Balance’ is viewed, interpreted and applied within the Bobath concept. Three key assumptions and an accompanying eight principles were identified as representing key aspects of Bobath clinical practice (Table 3-6 p.56). In summary these are: (a)i)ii)iii)) the integration of postural control and task performance with a specific focus on the quality of task performance; (b)i)ii)iii)) the equal importance of recovery of the trunk, head and limbs to optimize movement efficiency and quality; and, (c)i)ii)) the integration of sensory information in motor control and perception specifically with respect to facilitation, supporting surface and gravity. These statements identify what is unique to the Bobath concept in terms of clinical application and should form the basis of future effectiveness research.
**Figure 3 Study Procedure**

<table>
<thead>
<tr>
<th>Step</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request permission and cooperation of the IBITA Executive committee</td>
<td></td>
</tr>
<tr>
<td>Pilot study website and survey</td>
<td></td>
</tr>
<tr>
<td>Email invitation to all IBITA ‘Full’ members. Invitation also posted on members side of IBITA website</td>
<td></td>
</tr>
<tr>
<td>Invite reminder 1 week later</td>
<td></td>
</tr>
<tr>
<td>IBITA Full member asked to sign onto the study website and complete informed consent – ‘Delphi Panel’</td>
<td></td>
</tr>
<tr>
<td>Round #1 Survey</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Participants to rate their level of agreement and make comments</td>
<td></td>
</tr>
<tr>
<td>Email notification 1 week, and 2 days prior to survey deadline</td>
<td></td>
</tr>
<tr>
<td>Participant receives an email copy of their completed survey</td>
<td></td>
</tr>
<tr>
<td>Collation of responses</td>
<td></td>
</tr>
<tr>
<td>Revision of statements</td>
<td></td>
</tr>
<tr>
<td>Round #2 Survey</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Participants to rate their level of agreement and make comments</td>
<td></td>
</tr>
<tr>
<td>Email notification 1 week, and 2 days prior to survey deadline</td>
<td></td>
</tr>
<tr>
<td>Participant receives an email copy of their completed survey</td>
<td></td>
</tr>
<tr>
<td>Collation of responses</td>
<td></td>
</tr>
<tr>
<td>Revision of statements</td>
<td></td>
</tr>
<tr>
<td>Round #3 Survey</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Participants to rate their level of agreement</td>
<td></td>
</tr>
<tr>
<td>Email notification 1 week, and 2 days prior to survey deadline</td>
<td></td>
</tr>
<tr>
<td>Participant receives an email copy of their completed survey</td>
<td></td>
</tr>
<tr>
<td>Collation of responses</td>
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</tr>
<tr>
<td>Revision of statements</td>
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</tr>
<tr>
<td>Round #4 Survey</td>
<td>2 weeks</td>
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<tr>
<td>Participants to rate their level of agreement</td>
<td></td>
</tr>
<tr>
<td>Email notification 1 week, and 2 days prior to survey deadline</td>
<td></td>
</tr>
<tr>
<td>Participant receives an email copy of their completed survey</td>
<td></td>
</tr>
<tr>
<td>Collation of responses</td>
<td></td>
</tr>
<tr>
<td>Revision of statements</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 3-1 Delphi Study Procedure**
Table 3-1 Respondent and Statement Summary

<table>
<thead>
<tr>
<th></th>
<th>Round One</th>
<th>Round Two</th>
<th>Round Three</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong># Respondents</strong></td>
<td>89 of 204 Full</td>
<td>68 of 94 Delphi</td>
<td>66 of 94 Delphi</td>
</tr>
<tr>
<td></td>
<td>members (44%)</td>
<td>panel (72%)</td>
<td>panel (70%)</td>
</tr>
<tr>
<td><strong>Instructor category:</strong></td>
<td>Basic</td>
<td></td>
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<td></td>
<td>64 of 163</td>
<td>48</td>
<td>47</td>
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<td><strong>Instructor category:</strong></td>
<td>Advanced</td>
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<td></td>
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<td></td>
<td>14 of 28</td>
<td>12</td>
<td>13</td>
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<tr>
<td><strong>Instructor category:</strong></td>
<td>Senior</td>
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<td></td>
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<tr>
<td></td>
<td>7 of 13</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td><strong>English second language (ESL)</strong></td>
<td>61 of 89</td>
<td>48</td>
<td>47</td>
</tr>
<tr>
<td><strong>Conceptual statements underpinning Bobath interventions</strong></td>
<td>7 statements</td>
<td>11 statements</td>
<td>7 statements</td>
</tr>
<tr>
<td><strong>Statements identifying key aspects of clinical practice</strong></td>
<td>4 assumptions, 10 principles</td>
<td>3 assumptions, 8 principles</td>
<td>2 assumptions, 3 principles</td>
</tr>
<tr>
<td><strong>Statement summary</strong></td>
<td>21 statements, 4 did not reach consensus. 1 statement was eliminated.</td>
<td>22 statements, 2 statements did not reach consensus. Eight statements were accepted.</td>
<td>12 statements. All statements reached consensus with respect to level of agreement but one statement (balance statement) did not reach consensus for inclusion in the clinical framework.</td>
</tr>
</tbody>
</table>

Defining a Bobath Clinical Framework: A total of 19 statements reached consensus.
### Table 3-2 Round One - Initial Statements

<table>
<thead>
<tr>
<th>Over-arching statements</th>
<th>Mean</th>
<th>Coefficient of variation</th>
<th>Consensus Score %</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Bobath concept is …</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. An inclusive, individualized, remediation focused problem-solving approach</td>
<td>4.51</td>
<td>0.2</td>
<td>91.01</td>
</tr>
<tr>
<td>2. Based on contemporary theories of motor control, neuromuscular plasticity and motor learning</td>
<td>4.64</td>
<td>0.16</td>
<td>95.51</td>
</tr>
<tr>
<td>3. Based on an understanding that neurological pathology affects the whole body, and that current movement control is influenced by movement experiences pre and post the neurological lesion</td>
<td>4.56</td>
<td>0.19</td>
<td>92.13</td>
</tr>
<tr>
<td>4. Focused on the recovery potential of the individual to regain typical motor behaviour</td>
<td>4.21</td>
<td>0.2</td>
<td>82.01</td>
</tr>
<tr>
<td>5. <em>Not focused on the development of compensatory strategies for functional independence</em></td>
<td>4.17</td>
<td>0.25</td>
<td>78.41</td>
</tr>
<tr>
<td>6. Goal oriented to remediate impairments, minimize activity limitations, improve participation, thereby promoting independence and enhancing the quality of the person's daily activities</td>
<td>4.69</td>
<td>0.16</td>
<td>94.38</td>
</tr>
<tr>
<td>7. Not exclusive, such that additional therapies (e.g. BWST/CIMT) are selectively incorporated into the intervention plan to enhance the potential recovery of the individual</td>
<td>4.3</td>
<td>0.2</td>
<td>82.02</td>
</tr>
</tbody>
</table>

### Key aspects of clinical practice

**Assumption:**

- Movement analysis and treatment is based upon the integration of postural control and task performance, and the control of selective movement for the production of coordinated sequences of movement

<table>
<thead>
<tr>
<th>Principles:</th>
<th>Mean</th>
<th>Coefficient of variation</th>
<th>Consensus Score %</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)(i) Movement deficits are limitations in the variety of motor patterns normally available to healthy individuals</td>
<td>4.23</td>
<td>0.19</td>
<td>83.91</td>
</tr>
<tr>
<td>a)(ii) Intervention is a skillful, logical, analytical, step by step progression, individual to the individual, to achieve efficient muscle activation for success in a given activity or task</td>
<td>4.51</td>
<td>0.16</td>
<td>93.18</td>
</tr>
<tr>
<td>a)(iii) Task practice, repetition and velocity are used selectively to augment the intervention plan when these strategies maximize the potential of the individual with respect to improving postural control and selective voluntary movement</td>
<td>4.55</td>
<td>0.17</td>
<td>90.80</td>
</tr>
</tbody>
</table>

**Assumption:**

- Recovery of trunk and head control is as equally important as recovery of upper and lower limb function

<table>
<thead>
<tr>
<th>Principles:</th>
<th>Mean</th>
<th>Coefficient of variation</th>
<th>Consensus Score %</th>
</tr>
</thead>
<tbody>
<tr>
<td>b)(i) Posture and movement are separate, but interactive</td>
<td>3.97</td>
<td>0.3</td>
<td>73.86</td>
</tr>
<tr>
<td>b)(ii) Postural control is the organization of stability and mobility of the multi-joint kinetic chain in order to maintain, achieve or restore a state of balance during any posture or activity</td>
<td>4.66</td>
<td>0.15</td>
<td>95.45</td>
</tr>
</tbody>
</table>

### Key aspects of clinical practice (cont.)

<table>
<thead>
<tr>
<th>Mean</th>
<th>Coefficient of variation</th>
<th>Consensus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assumption:</td>
<td>of variation</td>
<td>Score %</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>c</strong>) Sensory information from multiple sources plays a fundamental role in motor control</td>
<td>4.76</td>
<td>0.14</td>
</tr>
<tr>
<td>Principles:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>c(i)</strong> Sensation, vision, action, perception and cognition are interlinked and interactive</td>
<td>4.65</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>c(ii)</strong> Facilitation, including therapeutic handling, manipulation of the environment and appropriate use of verbal cues, is a skilled aspect of intervention</td>
<td>4.74</td>
<td>0.14</td>
</tr>
<tr>
<td><strong>c(iii)</strong> The interaction of the body segment/s with a base of support (i.e. the segments of the person's body that is in contact with the supporting surface), is a critical component of the clinical presentation as it provides information on the ability of the individual to receive, integrate and respond appropriately to relevant afferent information</td>
<td>4.47</td>
<td>0.18</td>
</tr>
<tr>
<td>Assumption:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>d</strong>) Favors motor solutions that optimize quality/efficiency of movement while minimizing/discouraging the ability/tendency of the system to find movement solutions that involve movement compensations</td>
<td>4.45</td>
<td>0.17</td>
</tr>
<tr>
<td>Principles:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>d(i)</strong> Movement quality should be a determinant of effectiveness</td>
<td>4.16</td>
<td>0.23</td>
</tr>
<tr>
<td><strong>d(ii)</strong> The efficiency / quality of the movement should not deteriorate with increasing speed or frequency of the movement/activity</td>
<td>3.85</td>
<td>0.29</td>
</tr>
</tbody>
</table>
Table 3-3 Round Two

<table>
<thead>
<tr>
<th>Conceptual framework underpinning Bobath clinical interventions</th>
<th>Mean</th>
<th>Coefficient of variation</th>
<th>Consensus Score %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Bobath concept is an individualized problem-solving treatment approach. It provides a unique set of skills particularly with respect to movement analysis and the use of sensory input, can be applied to a broad range of clients, and can be combined with other interventions.</td>
<td>4.69</td>
<td>0.13</td>
<td>98.53</td>
</tr>
<tr>
<td>2. The Bobath concept is goal oriented to minimize activity limitations and impairments within the context of the individual’s environment and participation goals.</td>
<td>4.71</td>
<td>0.14</td>
<td>95.59</td>
</tr>
<tr>
<td>3. The Bobath concept is informed by contemporary theories of motor control, neuromuscular plasticity, biomechanics and motor learning providing the theoretical basis for the interpretation of posture, functional human movement analysis and recovery post CNS lesion.</td>
<td>4.75</td>
<td>0.14</td>
<td>94.03</td>
</tr>
<tr>
<td>4. Clinical practice of the Bobath concept is based on the understanding that somatosensation, vision, vestibular, action, perception, cognition and emotion are interlinked and interactive.</td>
<td>4.73</td>
<td>0.14</td>
<td>95.45</td>
</tr>
<tr>
<td>5. NEW STATEMENT The Bobath concept views balance as: (i) a complex, multidimensional concept requiring the integration of the vestibular, visual, somatosensory, musculoskeletal and cognitive systems; (ii) this system integration enables the planning and execution of movement patterns, postural control strategies, quickly and efficiently in anticipation of, and in response to, destabilizing forces in order to maintain equilibrium; and, (iii) is dependent upon the individual’s goals and environmental context.</td>
<td>4.51</td>
<td>0.2</td>
<td>89.71</td>
</tr>
<tr>
<td>6. The Bobath concept views postural control as the organization of stability, mobility and orientation of the multi-joint kinetic chain, which is dependent on an appropriate body schema in order to maintain, achieve or restore a state of balance during any posture or activity.</td>
<td>4.5</td>
<td>0.2</td>
<td>89.71</td>
</tr>
<tr>
<td>7. The Bobath concept is based on the understanding that neurological pathology affects the whole person and the resulting movement problems are influenced by that person’s lived experiences pre and post the neurological lesion.</td>
<td>4.69</td>
<td>0.15</td>
<td>94.12</td>
</tr>
<tr>
<td>8. The Bobath concept views ‘typical motor behavior’ as the motor behavior normally available to healthy individuals</td>
<td>4.33</td>
<td>0.2</td>
<td>83.33</td>
</tr>
<tr>
<td>9. The Bobath concept views ‘atypical motor behavior’ as disco-ordinated /invariable / and inefficient motor behavior of the more affected limb/s and body segments post CNS lesion.</td>
<td>3.67</td>
<td>0.3</td>
<td>61.19</td>
</tr>
<tr>
<td>10. The Bobath concept views ‘compensation’ as the motor behavior an individual uses to achieve a task with their less affected limb/s and body segments. This is not a primary focus of treatment using the Bobath concept.</td>
<td>3.26</td>
<td>0.42</td>
<td>53.03</td>
</tr>
<tr>
<td>11. The Bobath concept seeks to optimize functional independence by: (i) potentiating the reacquisition of as close as possible typical motor behavior; and, (ii) minimizing atypical and compensatory motor behavior and thus the development of secondary impairments, whilst recognizing the limitation of the CNS lesion, context-based to the individual.</td>
<td>4.44</td>
<td>0.18</td>
<td>91.18</td>
</tr>
</tbody>
</table>

Key aspects of clinical practice

<table>
<thead>
<tr>
<th>Mean</th>
<th>Coefficient</th>
<th>Consensus</th>
</tr>
</thead>
</table>

Assumption:

| A | The Bobath concept views movement analysis of task performance within a specific environment from the perspective of the integration of posture and movement through the lens of movement patterns, not as isolated movements. | 4.44 | 0.16 | 83.39 |

Principles:

| P | A goal of the Bobath concept is to improve movement strategies such that aspects of ease, rhythm, coordination, specificity, variability, repeatability and speed are addressed in task performance. | 4.70 | 0.11 | 96.97 |
| | Intervention is a skillful, logical, analytical process, individual to the client, therapist and environment to improve the quality of movement such that all body segments cooperate harmoniously with one another in the context of the task/s. | 4.71 | 0.12 | 96.67 |
| | Task selection in the Bobath concept must be meaningful to the client, and is specifically chosen and manipulated with respect to velocity, direction, load and magnitude in order to optimize the client’s postural control and selective voluntary movement. | 4.67 | 0.14 | 95.45 |

Assumption:

| B | Clinically, within the Bobath concept posture and movement are viewed as inseparable and interdependent. | 4.82 | 0.09 | 97.01 |

Principles:

| P | Quality of movement and the ability to co-ordinate movement whilst maintaining an appropriate postural background during a specific activity are a core focus of the Bobath concept. | 4.74 | 0.09 | 100.00 |
| | The Bobath concept seeks to achieve the greatest level of integration of trunk and head control with upper and lower limb function in order to optimize the efficiency of functional movement. | 4.56 | 0.13 | 93.94 |
| | Movement quality, ‘how’ a client completes a task, not just if they can complete a task, should be one determinant of effectiveness of Bobath interventions. | 4.57 | 0.14 | 94.03 |

Key aspects of clinical practice (cont.)

| Mean | Coefficient of variation | Consensus Score % |
Assumption:

c) The Bobath concept considers the role of sensory information in motor control, including the role of sensation in perception, a key aspect of clinical practice.

| Principles: |
|---|---|
| c)(i) Facilitation is the skilled interaction (verbal and non-verbal) between the therapist, the client and the client’s body. Facilitation includes therapeutic handling, manipulation of the environment, task selection and appropriate use of verbal and non-verbal cues in order to potentiate self-initiation of movement and/or create the necessary conditions for a movement experience that the client can not yet do alone. It is the art of therapeutic intervention. |
| c)(ii) The Bobath concept considers that the ability of the individual to selectively adapt motor activity and alignment of body segments with respect to a supporting surface and gravity, provides critical information on the ability of the individual to receive, integrate and respond appropriately to relevant information and is fundamental to the acquisition and development of postural control |

<table>
<thead>
<tr>
<th>Conceptual framework underpinning Bobath clinical interventions</th>
<th>Mean</th>
<th>Coefficient of variation</th>
<th>Consensus Score %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Bobath concept is an individualized problem-solving treatment approach. It provides a unique set of skills particularly with respect to movement analysis and the use of sensory input, can be applied to a broad range of clients, and can be combined with other interventions.</td>
<td>4.69</td>
<td>0.13</td>
<td>98.53</td>
</tr>
<tr>
<td>2. The Bobath concept is goal oriented to minimize activity limitations and impairments within the context of the individual’s environment and participation goals.</td>
<td>4.71</td>
<td>0.14</td>
<td>95.59</td>
</tr>
<tr>
<td>3. The Bobath concept is informed by contemporary theories of motor control, neuromuscular plasticity, biomechanics and motor learning providing the theoretical basis for the interpretation of posture, functional human movement analysis and recovery post CNS lesion.</td>
<td>4.75</td>
<td>0.14</td>
<td>94.03</td>
</tr>
<tr>
<td>4. Clinical practice of the Bobath concept is based on the understanding that somatosensation, vision, vestibular, action, perception, cognition and emotion are interlinked and interactive.</td>
<td>4.73</td>
<td>0.14</td>
<td>95.45</td>
</tr>
<tr>
<td>5. NEW STATEMENT The Bobath concept views balance as: (iv) a complex, multidimensional concept requiring the integration of the vestibular, visual, somatosensory, musculoskeletal and cognitive systems; (v) this system integration enables the planning and execution of movement patterns, postural control strategies, quickly and efficiently in anticipation of, and in response to, destabilizing forces in order to maintain equilibrium; and, (vi) is dependent upon the individual’s goals and environmental context.</td>
<td>4.51</td>
<td>0.2</td>
<td>89.71</td>
</tr>
<tr>
<td>6. The Bobath concept views postural control as the organization of stability, mobility and orientation of the multi-joint kinetic chain, which is dependent on an appropriate body schema in order to maintain, achieve or restore a state of balance during any posture or activity.</td>
<td>4.5</td>
<td>0.2</td>
<td>89.71</td>
</tr>
<tr>
<td>7. The Bobath concept is based on the understanding that neurological pathology affects the whole</td>
<td>4.69</td>
<td>0.15</td>
<td>94.12</td>
</tr>
</tbody>
</table>
person and the resulting movement problems are influenced by that person’s lived experiences pre and post the neurological lesion.

<table>
<thead>
<tr>
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<th></th>
<th>Mean</th>
<th>Coefficient</th>
<th>Consensus</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.</td>
<td>The Bobath concept views ‘typical motor behavior’ as the motor behavior normally available to healthy individuals</td>
<td>4.33</td>
<td>0.2</td>
<td>83.33</td>
</tr>
<tr>
<td>9.</td>
<td>The Bobath concept views ‘atypical motor behavior’ as disco-ordinated /invariable / and inefficient motor behavior of the more affected limb/s and body segments post CNS lesion.</td>
<td>3.67</td>
<td>0.3</td>
<td>61.19</td>
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<tr>
<td>10.</td>
<td>The Bobath concept views ‘compensation’ as the motor behavior an individual uses to achieve a task with their less affected limb/s and body segments. This is not a primary focus of treatment using the Bobath concept.</td>
<td>3.26</td>
<td>0.42</td>
<td>53.03</td>
</tr>
<tr>
<td>11.</td>
<td>The Bobath concept seeks to optimize functional independence by: (i) potentiating the reacquisition of as close as possible typical motor behavior; and, (ii) minimizing atypical and compensatory motor behavior and thus the development of secondary impairments, whilst recognizing the limitation of the CNS lesion, context-based to the individual.</td>
<td>4.44</td>
<td>0.18</td>
<td>91.18</td>
</tr>
</tbody>
</table>

Key aspects of clinical practice

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Mean</th>
<th>Coefficient</th>
<th>Consensus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assumption:</td>
<td>The Bobath concept views movement analysis of task performance within a specific environment from the perspective of the integration of posture and movement through the lens of movement patterns, not as isolated movements.</td>
<td>4.44</td>
<td>0.16</td>
<td>83.39</td>
</tr>
</tbody>
</table>

Principles:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Mean</th>
<th>Coefficient</th>
<th>Consensus</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)(i)</td>
<td>NEW STATEMENT A goal of the Bobath concept is to improve movement strategies such that aspects of ease, rhythm, coordination, specificity, variability, repeatability and speed are addressed in task performance.</td>
<td>4.70</td>
<td>0.11</td>
<td>96.97</td>
</tr>
<tr>
<td>a)(ii)</td>
<td>Intervention is a skilful, logical, analytical process, individual to the client, therapist and environment to improve the quality of movement such that all body segments cooperate harmoniously with one another in the context of the task/s.</td>
<td>4.71</td>
<td>0.12</td>
<td>96.67</td>
</tr>
<tr>
<td>a)(iii)</td>
<td>Task selection in the Bobath concept must be meaningful to the client, and is specifically chosen and manipulated with respect to velocity, direction, load and magnitude in order to optimize the client’s postural control and selective voluntary movement.</td>
<td>4.67</td>
<td>0.14</td>
<td>95.45</td>
</tr>
</tbody>
</table>

Assumption:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Mean</th>
<th>Coefficient</th>
<th>Consensus</th>
</tr>
</thead>
<tbody>
<tr>
<td>b)</td>
<td>Clinically, within the Bobath concept posture and movement are viewed as inseparable and interdependent.</td>
<td>4.82</td>
<td>0.09</td>
<td>97.01</td>
</tr>
</tbody>
</table>
### Principles:

<table>
<thead>
<tr>
<th></th>
<th>principles:</th>
</tr>
</thead>
</table>
| b)(i) | **NEW STATEMENT**  
Quality of movement and the ability to co-ordinate movement whilst maintaining an appropriate postural background during a specific activity are a core focus of the Bobath concept. | 4.74 | 0.09 | 100.00 |
| b)(ii) | The Bobath concept seeks to achieve the greatest level of integration of trunk and head control with upper and lower limb function in order to optimize the efficiency of functional movement. | 4.56 | 0.13 | 93.94 |
| b)(iii) | Movement quality, ‘how’ a client completes a task, not just if they can complete a task, should be one determinant of effectiveness of Bobath interventions. | 4.57 | 0.14 | 94.03 |

**Key aspects of clinical practice (cont.)**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Coefficient of variation</th>
<th>Consensus Score %</th>
</tr>
</thead>
</table>

### Assumption:

|   | Assumption:  
The Bobath concept considers the role of sensory information in motor control, including the role of sensation in perception, a key aspect of clinical practice. | 4.79 | 0.09 | 98.48 |

### Principles:

<table>
<thead>
<tr>
<th></th>
<th>principles:</th>
</tr>
</thead>
<tbody>
<tr>
<td>c)(i)</td>
<td>Facilitation is the skilled interaction (verbal and non-verbal) between the therapist, the client and the client’s body. Facilitation includes therapeutic handling, manipulation of the environment, task selection and appropriate use of verbal and non-verbal cues in order to potentiate self-initiation of movement and/or create the necessary conditions for a movement experience that the client can not yet do alone. It is the art of therapeutic intervention.</td>
</tr>
<tr>
<td>c)(ii)</td>
<td>The Bobath concept considers that the ability of the individual to selectively adapt motor activity and alignment of body segments with respect to a supporting surface and gravity, provides critical information on the ability of the individual to receive, integrate and respond appropriately to relevant information and is fundamental to the acquisition and development of postural control</td>
</tr>
</tbody>
</table>
Table 3-4 Round Three

<table>
<thead>
<tr>
<th>Conceptual framework underpinning Bobath clinical interventions</th>
<th>Mean</th>
<th>Coefficient of variation</th>
<th>Consensus Score %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 The Bobath concept is an individualized problem-solving treatment approach. It provides the therapist with a unique set of skills particularly with respect to movement analysis and the use of sensory input, can be applied to a broad range of clients with movement disorders, and can be combined with other interventions</td>
<td>4.81</td>
<td>0.90</td>
<td>98.41</td>
</tr>
<tr>
<td>2 The goal of the Bobath concept is to minimize activity limitations and impairments within the context of the individual’s environment and participation goals.</td>
<td>4.76</td>
<td>0.10</td>
<td>96.83</td>
</tr>
<tr>
<td>4 Clinical practice of the Bobath concept is based on the understanding that sensation, action, perception, cognition and emotion are interlinked and interactive</td>
<td>4.8</td>
<td>0.11</td>
<td>96.92</td>
</tr>
</tbody>
</table>
| 5 Within the Bobath concept balance is viewed as:  
(i) a complex, multidimensional concept;  
(ii) requiring multi-system integration enabling the planning and execution of movement patterns, postural control strategies, quickly and efficiently in anticipation of, and in response to, destabilizing forces in order to maintain equilibrium; and,  
(iii) is dependent upon the individual’s goals and environmental context | 4.52 | 0.15 | 92.31 |
| Should the statement with respect to balance be included in a Bobath clinical framework? | Yes | 75.41 | |
| No | 24.59 | |
| 6 Within the Bobath concept postural control is viewed as the organization of stability, mobility and orientation of the multi-joint kinetic chain, which is reflective of the individual’s body schema in order to maintain, achieve or restore a state of equilibrium during any posture or activity | 4.58 | 0.15 | 95.16 |
| 8 Within the Bobath concept ‘typical motor behavior’ is viewed as representative of the range of motor behavior available to individuals without a CNS lesion | 4.32 | 0.18 | 87.69 |
| 11 The Bobath concept seeks to optimize functional independence by:  
(i) potentiating the reacquisition of as close as possible typical motor behavior; and,  
(ii) minimizing atypical motor behaviour (of the more affected body segments/limbs) and compensatory motor behavior (of the less affected body segments/limbs) and thus the development of secondary impairments, whilst recognizing the limitation of the CNS lesion context-based to the individual | 4.34 | 0.18 | 92.19 |
<table>
<thead>
<tr>
<th>Key aspects of clinical practice</th>
<th>Mean</th>
<th>Coefficient of variation</th>
<th>Consensus Score %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assumption:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Movement analysis of task performance within a specific environment is viewed by the Bobath concept from the perspective of the integration of posture and movement</td>
<td>4.71</td>
<td>0.12</td>
<td>98.48</td>
</tr>
<tr>
<td><strong>Principles:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)(ii) The Bobath concept seeks to achieve integration of trunk and head control with upper and lower limb function to improve the efficiency of functional movement</td>
<td>4.74</td>
<td>0.10</td>
<td>98.48</td>
</tr>
<tr>
<td>b)(iii) Movement quality, ‘how’ a client completes a task, should be one determinant of effectiveness of Bobath interventions</td>
<td>4.55</td>
<td>0.15</td>
<td>92.42</td>
</tr>
<tr>
<td><strong>Assumption:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Within the Bobath concept the role of sensory information in motor control and perception are considered a key aspect of clinical practice</td>
<td>4.77</td>
<td>0.13</td>
<td>93.85</td>
</tr>
<tr>
<td><strong>Principles:</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>c)(i) Facilitation is the skilled interaction between the therapist, the client and the client’s body. Facilitation includes therapeutic handling, manipulation of the environment, task selection and appropriate use of verbal and non-verbal cues in order to potentiate self-initiation/termination of movement and/or create the necessary conditions for a movement experience that the client can not yet do alone</td>
<td>4.66</td>
<td>0.17</td>
<td>93.85</td>
</tr>
<tr>
<td>Round One</td>
<td>Round Two</td>
<td>Round Three</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>An inclusive, individualized, remediation focused problem-solving approach.</td>
<td>The Bobath concept is an individualized problem-solving treatment approach. It provides a unique set of skills particularly with respect to movement analysis and the use of sensory input, can be applied to a broad range of clients, and can be combined with other interventions.</td>
<td>The Bobath concept is an individualized problem-solving treatment approach. It provides the therapist with a unique set of skills particularly with respect to movement analysis and the use of sensory input, can be applied to a broad range of clients with movement disorders, and can be combined with other interventions.</td>
<td></td>
</tr>
<tr>
<td>Based on contemporary theories of motor control, neuromuscular plasticity and motor learning.</td>
<td>The Bobath concept is informed by contemporary theories of motor control, neuromuscular plasticity, biomechanics and motor learning providing the theoretical basis for the interpretation of posture, functional human movement analysis and recovery post CNS lesion.</td>
<td>The Bobath concept is based on the understanding that neurological pathology affects the whole person and the resulting movement problems are influenced by that person’s lived experiences pre and post the neurological lesion.</td>
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<td>Based on an understanding that neurological pathology affects the whole body, and that current movement control is influenced by movement experiences pre and post the neurological lesion.</td>
<td>The Bobath concept is based on the understanding that neurological pathology affects the whole body, and that current movement control is influenced by movement experiences pre and post the neurological lesion.</td>
<td>Within the Bobath concept, ‘typical motor behavior’ is viewed as representative of the range of motor behavior available to individuals without a CNS lesion.</td>
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<td>Focused on the recovery potential of the individual to regain typical motor behaviour</td>
<td>The Bobath concept views ‘atypical motor behavior’ as dis-co-ordinated /invariable / and inefficient motor behavior of the more affected limb/s and body segments post CNS lesion.</td>
<td>Within the Bobath concept, ‘compensation’ as the motor behavior an individual uses to achieve a task with their less affected limb/s and body segments. This is not a primary focus of treatment using the Bobath concept.</td>
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<td>Not focused on the development of compensatory strategies for functional independence</td>
<td>The Bobath concept views ‘compensation’ as the motor behavior an individual uses to achieve a task with their less affected limb/s and body segments. This is not a primary focus of treatment using the Bobath concept.</td>
<td>The goal of the Bobath concept is to minimize activity limitations and impairments within the context of the individual’s environment and participation goals.</td>
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<td>Goal oriented to remediate impairments, minimize activity limitations, improve participation, thereby promoting independence and enhancing the quality of the person’s daily activities</td>
<td>The Bobath concept is goal oriented to minimize activity limitations and impairments within the context of the individual’s environment and participation goals.</td>
<td>The goal of the Bobath concept is to minimize activity limitations and impairments within the context of the individual’s environment and participation goals.</td>
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<td>Not exclusive, such that additional therapies (e.g. BWST/CIMT) are selectively incorporated into the intervention plan to enhance the potential recovery of the individual</td>
<td>Clinical practice of the Bobath concept is based on the understanding that somatosensation, vision, vestibular, action, perception, cognition and emotion are interlinked and interactive.</td>
<td>Clinical practice of the Bobath concept is based on the understanding that sensation, action, perception, cognition and emotion are interlinked and interactive.</td>
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<td>Round One</td>
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| The Bobath concept views balance as:  
  (i) a complex, multidimensional concept requiring the integration of the vestibular, visual, somatosensory, musculoskeletal and cognitive systems;  
  (ii) this system integration enables the planning and execution of movement patterns, postural control strategies, quickly and efficiently in anticipation of, and in response to, destabilizing forces in order to maintain equilibrium; and,  
  (iii) is dependent upon the individual’s goals and environmental context. | Within the Bobath concept, balance is viewed as:  
  (iv) a complex, multidimensional concept;  
  (v) requiring multi-system integration enabling the planning and execution of movement patterns, postural control strategies, quickly and efficiently in anticipation of, and in response to, destabilizing forces in order to maintain equilibrium; and,  
  (vi) is dependent upon the individual’s goals and environmental context. [This statement reached consensus but did not reach consensus to be included in the Bobath clinical framework] | The Bobath concept seeks to optimize functional independence by:  
  (iii) potentiating the reacquisition of as close as possible typical motor behavior; and,  
  (iv) minimizing atypical motor behavior (of the more affected body segments/limbs) and compensatory motor behavior (of the less affected body segments/limbs) and thus the development of secondary impairments, whilst recognizing the limitation of the CNS lesion context-based to the individual. |
| The Bobath concept views postural control as the organization of stability, mobility and orientation of the multi-joint kinetic chain, which is dependent on an appropriate body schema in order to maintain, achieve or restore a state of balance during any posture or activity. | Within the Bobath concept, postural control is viewed as the organization of stability, mobility and orientation of the multi-joint kinetic chain, which is reflective of the individual's body schema in order to maintain, achieve or restore a state of equilibrium during any posture or activity. | The Bobath concept seeks to optimize functional independence by:  
  (i) potentiating the reacquisition of as close as possible typical motor behavior; and,  
  (ii) minimizing atypical and compensatory motor behavior and thus the development of secondary impairments, whilst recognizing the limitation of the CNS lesion, context-based to the individual. |


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<tr>
<td>Assumption:</td>
<td>The Bobath concept views movement analysis of task performance within a specific environment from the perspective of the integration of posture and movement through the lens of movement patterns, not as isolated movements.</td>
<td>a) Movement analysis of task performance within a specific environment is viewed by the Bobath concept from the perspective of the integration of posture and movement.</td>
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<td>Movement analysis and treatment is based upon the integration of postural control and task performance, and the control of selective movement for the production of coordinated sequences of movement.</td>
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<td>Principles:</td>
<td>a(i) A goal of the Bobath concept is to improve movement strategies such that aspects of ease, rhythm, coordination, specificity, variability, repeatability and speed are addressed in task performance.</td>
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<td>Movement deficits are limitations in the variety of motor patterns normally available to healthy individuals</td>
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<td>Intervention is a skillful, logical, analytical, step by step progression, individual to the individual, to achieve efficient muscle activation for success in a given activity or task</td>
<td>a(ii) Intervention is a skillful, logical, analytical process, individual to the client, therapist and environment to improve the quality of movement such that all body segments cooperate harmoniously with one another in the context of the task/s.</td>
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<td>Task practice, repetition and velocity are used selectively to augment the intervention plan when these strategies maximize the potential of the individual with respect to improving postural control and selective voluntary movement</td>
<td>a(iii) Task selection in the Bobath concept must be meaningful to the client, and is specifically chosen and manipulated with respect to velocity, direction, load and magnitude in order to optimize the client's postural control and selective voluntary movement.</td>
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<td>Assumption:</td>
<td>b) Clinically, within the Bobath concept posture and movement are viewed as inseparable and interdependent.</td>
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<td>Recovery of trunk and head control is as equally important as recovery of upper and lower limb function</td>
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<td>Principles:</td>
<td>b(i) Quality of movement and the ability to coordinate movement whilst maintaining an appropriate postural background during a specific activity are a core focus of the Bobath concept.</td>
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<td>Posture and movement are separate, but interactive</td>
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<td>Postural control is the organization of stability and mobility of the multi-joint kinetic chain in order to maintain, achieve or restore a state of balance during any posture or activity</td>
<td>The Bobath concept seeks to achieve the greatest level of integration of trunk and head control with upper and lower limb function in order to optimize the efficiency of functional movement.</td>
<td>b(ii) The Bobath concept seeks to achieve integration of trunk and head control with upper and lower limb function to improve the efficiency of functional movement.</td>
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<td>Movement quality, ‘how’ a client completes a task, not just if they can complete a task, should be one determinant of effectiveness of Bobath interventions.</td>
<td>b(iii) Movement quality, ‘how’ a client completes a task, should be one determinant of effectiveness of Bobath interventions.</td>
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<td>Assumption: Sensory information from multiple sources plays a fundamental role in motor control</td>
<td>The Bobath concept considers the role of sensory information in motor control, including the role of sensation in perception, a key aspect of clinical practice.</td>
<td>c) Within the Bobath concept the role of sensory information in motor control and perception are considered a key aspect of clinical practice.</td>
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<td>Principles: c(i)(ii) Sensation, vision, action, perception and cognition are interlinked and interactive</td>
<td>Facilitation is the skilled interaction (verbal and non-verbal) between the therapist, the client and the client’s body. Facilitation includes therapeutic handling, manipulation of the environment, task selection and appropriate use of verbal and non-verbal cues in order to potentiate self-initiation of movement and/or create the necessary conditions for a movement experience that the client can not yet do alone. It is the art of therapeutic intervention.</td>
<td>c(i) Facilitation is the skilled interaction between the therapist, the client and the client’s body. Facilitation includes therapeutic handling, manipulation of the environment, task selection and appropriate use of verbal and non-verbal cues in order to potentiate self-initiation/termination of movement and/or create the necessary conditions for a movement experience that the client can not yet do alone.</td>
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<td>The interaction of the body segment/s with a base of support (i.e. the segments of the person's body that is in contact with the supporting surface), is a critical component of the clinical presentation as it provides information on the ability of the individual to receive, integrate and respond appropriately to relevant afferent information</td>
<td>c(ii) The Bobath concept considers that the ability of the individual to selectively adapt motor activity and alignment of body segments with respect to a supporting surface and gravity, provides critical information on the ability of the individual to receive, integrate and respond appropriately to relevant information and is fundamental to the acquisition and development of postural control.</td>
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<td>Favors motor solutions that optimize quality/efficiency of movement while minimizing/discouraging the ability/tendency of the system to find movement solutions that involve movement compensations</td>
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<td>Movement quality should be a determinant of effectiveness.</td>
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<td>The efficiency/quality of the movement should not deteriorate with increasing speed or frequency of the movement/activity.</td>
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Chapter 4
The Conceptualization of Movement by expert Bobath Instructors in Neurological Rehabilitation

Vaughan-Graham J, Patterson K, Zabjek K, Cott C,

Prepared manuscript

4.1. Introduction

4.1.1. Movement is Integral to Physiotherapy Practice and Research

Movement is considered a core aspect of physiotherapy practice (Jull, 2013). There has been some theory as to how movement is conceptualized by the physiotherapy (PT) profession (Hislop, 1975); (C. A. Cott et al., 1995); (Sahrmann, 2014), but in general there is an associated underdevelopment of a PT theoretical framework (Wikstrom-Grotell & Eriksson, 2012). Human movement in PT has been described as physical, emotional, sociocultural and existential (Wikstrom-Grotell & Eriksson, 2012), thereby embracing a humanistic perspective (Øberg, Normann, & Gallagher, 2015). This view of human movement is immersed within a pragmatic paradigm that seeks to establish a philosophical stance embracing both clinical practice and research (Wikstrom-Grotell & Eriksson, 2012). However, PT research over the past three decades has been located primarily within the positivist paradigm focusing on determining the effectiveness of interventions (Costa et al., 2011); (Canadian Stroke Strategy, 2010). This narrow perspective of knowledge generation in PT ignores not only the broader perspective of PT practice in prevention, wellness and health management as well as the consideration of context (Wikstrom-Grotell & Eriksson, 2012); (Gibson, 2016)(p.5), but has contributed to an underdevelopment of the evidence-base with respect to professional judgment. It is through the clinical reasoning process, on which professional judgment is based, that determines if an intervention is relevant, reasonable and appropriate in an individual’s presentation and context (Fish & Higgs, 2008). This aspect of professional practice has received much less attention in physiotherapy research to date.
4.1.2. Movement and Neuro-Rehabilitation

Stroke, a neurological condition, is the leading cause of long-term disability in adults in Canada (Johansen et al., 2006). Recent advances in the acute management of stroke have reduced stroke mortality, whilst simultaneously increasing the likelihood that individuals are living with the effects of stroke (J. D. Edwards et al., 2010). It is estimated of those Canadians who sustain a stroke, 75% will have a residual disability, 40% of which will have moderate to severe impairments (Teasell et al., 2009).

Increased stroke severity is associated with major physical symptoms, including problems with balance, mobility, upper limb and hand function, leading to a reduction in health related quality of life (HRQOL) (J. D. Edwards et al., 2010);(Beyaert, Vasa, & Frykberg, 2015). Neuro-rehabilitation aims to optimize recovery and minimize disability (Kitago & Krakauer, 2013), therefore the analysis of movement performance and interventions focused on improving movement performance (Mindy F Levin, Liebermann, Parmet, & Berman, 2015) is important to improving the HRQOL of Canadians who have sustained a stroke. However, how therapists conceptualize movement and thereby address neurological movement related problems has received little attention to date (Beeston & Simons, 1996); (Wikstrom-Grotell & Eriksson, 2012).

One of the most widely used neuro-rehabilitation approaches, the Bobath concept, identifies movement performance as a key aspect of clinical practice (Vaughan-Graham et al., 2015b);(Vaughan-Graham & Cott, 2016 (in press)). Thus the Bobath concept provides an excellent model for understanding how movement is conceptualized by rehabilitation therapists in clinical practice.

4.2. Research Background

4.2.1. Physiotherapy Theories

Movement, a health-promoting tool, was first described as a theory by Ling (1776-1839) based on a holistic view of man, but was later developed within the framework of medicine, in particular anatomy and physiology, in the early part of the twentieth century (Wikstrom-Grotell & Eriksson, 2012). With the exception of the work of Hislop (1975) and Cott (1995) PT has lacked an over-arching theoretical framework essentially borrowing theoretical knowledge from the bio-medical, physical and social sciences (Gibson et al., 2010). Hislop (1975) highlighted
the lack of a philosophical overview of PT and proposed a grand theory of human movement, pathokinesiology, based on six levels of the natural system namely: cells; tissues; organs; systems; person; and, family each of which correlates with a basic science. Although Hislop acknowledged the role of the person and family her theory was not explicit with respect to the sociocultural and environmental influences on human movement (C. A. Cott et al., 1995). In addition, implicit in a pathokinesiological approach to movement is a reductionist model to PT in which the pathology is identified, isolated and therefore treated and resolved. Where this maybe the case in some instances it does not address the equally important role of PT in mental health, prevention, wellness and incurable or chronic illnesses (Pratt, 1989); (Schlegel, 1986).

Musings on whether the term ‘Pathokinesiology’ should become the basic science and source of theory in PT (Rothstein, 1986) gave rise to discussions on diagnosis, classification, or a PT taxonomy which, not surprisingly, coincided with the process of professionalization of PT (Rose, 1988); (Sahrmann, 1988); (Thornquist, 1994). This debate facilitated PT away from a pathokinesiology framework as the discussion acknowledged that a medical diagnosis did not adequately represent PT practice. It was suggested that PT needs to identify and classify the non-disease clinical phenomena that physiotherapist’s assess and treat (Rose, 1988); (A. M. Jette, 1989); (Coffin-Zadai, 2007). Likewise PT interventions would only be able to demonstrate their effectiveness for a condition that was clearly stated (Guccione, 1991), whilst recognizing that a humanistic approach to PT practice was more than the sum of its parts (Pratt, 1989), and that movement requires the integration of cognition, perception and action (Mulder, 1991); (Di Pino, Maravita, Zollo, Guglielmelli, & Di Lazzaro, 2014). Thus health, and movement as a health-promoting tool, within PT is considerably broader than a science based on pathokinesiology, it requires a science that respects the whole person, not just a body segment (Nicholls & Gibson, 2010).

Some twenty years after Hislop’s proposal, Cott et al. (1995) published ‘The Movement Continuum Theory of Physical Therapy’ (MCT) as a grand theory of PT with movement as its focus, identifying common concepts and overarching principles, thus providing an overall conceptual framework inclusive of middle-range theories (C. A. Cott et al., 1995). The MCT consists of eight principles, three of which are shared with other disciplines. These are: i) movement is essential to human life; ii) movement occurs on a continuum from microscopic to the person in society; and, iii) movement is influenced by physical, psychological, social and
environmental factors. The remaining five principles conceptualize movement from the PT perspective as multi-dimensional. Each movement level on the continuum from molecular to the person in society are interdependent and interactive with internal and external factors. It is the physiotherapist’s understanding of the body’s physiological functioning and the potential influence of pathology on the person along the movement continuum that enables the identification of the person’s current and preferred movement capability (CMC/PMC) as well as their maximum achievable movement potential (MAMP). The focus of PT with respect to quantity and quality of movement is to minimize any potential or existing differential between the PMC and CMC against the background knowledge of the MAMP. The MCT formed the basis of the World Confederation of Physical Therapy (2011) description of Physical Therapy (WCPT, 2011).

More recently the American Physical Therapy Association (APTA) has proposed and adopted the concept of a ‘Human Movement System’ (HuMS) as a physiological system and foundational science of PT (Sahrmann, 2014). The HuMS incorporates kinesiopathology and pathokinesiology as movement system concepts, and applies to movement from the sub-cellular to the system level including interaction with the environment (Sahrmann, 2014). However, the HuMS is focused on physiological organ systems (nervous, musculo, skeletal, pulmonary, cardiovascular, endocrine and integumentary) and thus does not make explicit how sociocultural and environmental factors may influence the HuMS, nor considers the role of the person, rather than the body.

Although there appears to be consensus that movement is the core focus of PT (Hislop, 1975);(C. A. Cott et al., 1995);(Sahrmann, 2014) there has been limited empirical research with respect to the construct of movement (Allen, 2007). Movement quality or performance is a term frequently used by physiotherapists, suggested to include bodily and mental characteristics, and comprises both a global impression of the whole movement such as coordination as well as specific elements such as alignment and accuracy (Skjaerven et al., 2008).

Allen (2007) operationalized the MCT by identifying six dimensions of movement (flexibility, strength, speed, accuracy, adaptability and endurance) from which a self-report ‘Movement Ability Measure’ (MAM) was developed (Allen, 2007). Skjaerven et al. (2008) investigated the phenomena of movement quality with fifteen physiotherapists, five from each practice area of
neurology, psychiatry and primary health care. The participants defined movement quality with respect to four themes which were: i) biomechanical, representing a spatial aspect; ii) physiological, representing a temporal aspect; iii) psycho-socio-cultural, representing the use of energy; and, iv) existential, representing personal and unifying aspects (Skjaerven et al., 2008). However, there is still a need for clarification on the specific elements constituting movement quality (Skjaerven et al., 2008), as walking ‘better’ does not necessarily equate to walking faster (Tansey et al., 2012).

In summary, the literature suggests that movement is a unifying and core aspect of PT practice, but how movement, specifically movement quality is conceptualized from the perspective of the therapist and the client remains under debate and requires further investigation. It is clear however therapists conceptualize movement from the broader ‘person’ perspective not only from a ‘body’ or ‘body segment’ perspective.

4.2.2. The Bobath concept

The Bobath concept, referred to as ‘NeuroDevelopmental Therapy’ (NDT) in the American literature, is one of the most widely used neuro-rehabilitation approaches, providing therapists with a conceptual framework for their clinical interventions (Raine, 2009). A recent best evidence synthesis of Bobath studies, using traditional experimental designs, concluded that the Bobath concept is no more effective than other approaches (Kollen et al., 2009). However, the application of a package of interventions over a pre-determined time period to a group of individuals with very different movement and perceptual/cognitive problems is the antithesis of individualized person-centred care (Vaughan-Graham et al., 2015a). A hallmark of the Bobath concept is its interaction between assessment and treatment (Bobath, 1978);(VGraham et al., 2009), with an emphasis on the complex clinical reasoning process, enabling a continuously evolving treatment, response-based to the individual and context (Johnson, 2009);(C. Cott et al., 2011). The Bobath concept focuses on the resolution of movement problems affecting client-identified activity restrictions and participation limitations (Vaughan-Graham et al., 2015a). Within the Bobath concept movement analysis of task performance is viewed from the perspective of the integration of posture and movement such that aspects of ease rhythm, coordination, specificity, variability, repeatability and speed are addressed (Vaughan-Graham &
Cott, 2016 (in press)). As such, the Bobath concept is a good model for examining how therapists conceptualize movement.

The purpose of this study is to gain an understanding of how expert Bobath (IBITA) instructors conceptualize movement as an aspect of their clinical reasoning.

4.3. Research Methodology

Interpretive description is a qualitative research approach that develops discipline-specific knowledge about a phenomenon that has clinical utility. Interpretive description provides a framework, which is discipline oriented and situated within the current empirical evidence, to advance the understanding of experiential, tacit knowledge through the application of specific methods within the health sciences (Sally Thorne, 2008)(p.23-51). Interpretive methods seek to capture the influence of interactions, whilst taking into consideration the social and environmental contexts enabling the investigation of complex processes within the practice context (Carrier et al., 2010). Interpretive description draws upon an inductive reasoning approach to generate empirical disciplinary knowledge that is credible, meaningful and relevant to the clinical context (Sally Thorne et al., 2004).

The International Bobath Instructors Training Association (IBITA) is the internationally recognized expert Bobath association uniting 275 Bobath instructors across 29 countries worldwide. Expert Bobath instructors, recruited from IBITA, were video-recorded during an initial 1.5 hour clinical session with a client immediately followed by a focused interview whilst reviewing the video of their clinical session.

4.3.1. Study Sample

IBITA has three membership categories, Full (actively practicing and teaching the Bobath concept), Associate (those currently enrolled in the Bobath Instructor Training Program) and Retired. There are three categories for Full members - Basic, Advanced and Senior - and all members are required to fulfill specific requirements in order to maintain their IBITA Instructor status. There are currently 201 Full members comprising 12 Senior instructors, 31 Advanced instructors and 158 Basic course instructors. Full IBITA members formed the study sample. It was important that participating IBITA instructors were from different countries, were of varying
levels of instructor status and had been mentored by different Senior Instructors to ensure that potential differences in clinical reasoning and clinical application of the concept were explored.

A purposive sampling strategy was used to ensure each participant is capable of clearly articulating their clinical reasoning process in order to fulfill the research aims (Sally Thorne, 2008)(p.89-92). (Table 4-1 Participant Inclusion Criteria p.85)

4.3.2. Study Locations

Four study locations were identified during the period December 2014 – September 2015. These study locations were chosen for convenience as the first author was in these locations either instructing Bobath courses or attending the IBITA Annual General Meeting (AGM). The study locations were: (i) Melbourne, Australia in December 2014; (ii) Madrid, Spain in March 2015; (iii) Brescia, Italy in June 2015; and, (iv) Lisbon, Portugal in September 2015. This enabled access to Bobath instructors with varying levels of instructor experience from different parts of the world, especially in Lisbon where 118 Bobath instructors attended the IBITA 2015 AGM. Each IBITA member country has an identified ‘IBITA Country Representative’ in order to facilitate IBITA member communications in each country.

4.3.3. Recruitment

There were three aspects to recruitment for this study: 1) Research participants (IBITA Full members; 2) Clinical facility in which to perform data collection during the clinical sessions; and, 3) Patients for the clinical sessions.

4.3.3.1. Research Participants

Voluntary recruitment of IBITA Full members was sought through the IBITA Executive Committee. An introductory study email was sent to all IBITA Full members and a Participant Invitation and information letter was sent to the IBITA country representatives of each of the proposed study locations (Figure 4-1 Participant Recruitment Process p.86).

4.3.3.2. Clinical Facility

The first author in consultation with the IBITA country representative identified a geographically accessible location for the IBITA instructors and adequate facilities for a clinical session to be
undertaken e.g. wheelchair accessible, access to hi-lo plinths and availability of treatment equipment.

4.3.3.3. Patients

Although the participation of the patients was key to the success of the study they were not the units of analysis. Voluntary recruitment of patients was facilitated by the clinical facility (Figure 4-2 Patient Selection & Recruitment p.87). Patient selection was based on clinical presentation, rather than diagnosis, to facilitate homogeneity in the patient presentation. The requirement to be able to perform a reaching activity once facilitated into single leg standing on the less affected lower limb infers that the patient has sufficient anti-gravity activity to potentiate standing without the use of the upper limb, and does not have a significant perceptual deficit that limits the ability to achieve midline orientation (Table 4-2 – Patient Selection Criteria p.88).

4.3.4. Data Collection

The first author video-recorded one clinical session per IBITA participant, maximum 1.5 hours duration, immediately followed by a video-recorded in-depth focused interview of the IBITA participant, whilst reviewing the video of his/her clinical session. The use of video-recording of interactions and review is known in the field as ‘stimulated recall’ (Norman, 2005) to facilitate the articulation by the participant of “how they decided to do what they do”, and also to allow for inclusion of non-verbal communication, specifically therapeutic touch. An interview guide (Appendix A p.148) was utilized to promote discussion on the participant’s thinking processes including questions such as:

“Tell me what you were thinking about as you assessed and treated this patient?” and “What role do your hands play in your clinical reasoning process?” Additionally open-ended questions were used, for example “Tell me about…”, “Could you describe further…”, and “Could you tell me about what you were thinking about while…”. The immediacy of the interview after the clinical session is to ensure that the participant articulates as closely as possible the actual clinical reasoning process as it occurred. Each research participant was requested to complete a ‘Participant Professional Profile Form’ (Appendix B p.149) providing demographic information including education, years of clinical experience, level of instructor status and year gained, current practice setting, teaching experience, and time spent in direct patient care vs. teaching
commitments (Table 4-3 – Summary of Participant Demographics p.89 and Table 4-4 – Summary of Patient Demographics p.90).

4.4. Data Analysis

The focused interviews were transcribed verbatim by the first author and provided the raw data for the study. Data transcription immediately followed data collection. As the data were collected over four specific time periods insights developed during the data collection phases informed ongoing data collection. In addition, the periods where no new data were collected provided an opportunity to refine the analytic process such that patterns and relationships between codes, categories and thematic development could be considered and compared with respect to the successive and previous data collection phases.

The interview transcripts were imported into the NVivo qualitative software program to facilitate the coding and analytic process. Coding was a progressive, iterative process, beginning with labeling segments of the data, then through making comparisons and writing memos the data was reassembled into categories. By continually comparing data from the same research participant, between research participants, comparing categories, and data with categories, whilst simultaneously writing memos to document this process the analysis was taken to successive levels of interpretation.

For example, initial codes such as ‘considering the whole person’, ‘current movement abilities’ and ‘social history’ were grouped under the category ‘The Individual’, whereas codes such as ‘influence of therapeutic handling’, ‘influence of the environment’ and ‘influence of the movement experience’ were grouped under ‘sensory experience’. These categories were later brought together under the theme ‘Movement - The lived experience’. Alignment of body segments was established as a theme early on as a result of a number of developed codes such as ‘alignment’, ‘biomechanics’, ‘quality of movement’, ‘therapist handling’ and ‘manipulation of the environment’ which were all addressing the alignment of body segments and how this related to movement. Likewise, postural control and selective movement were consistently discussed throughout all the transcripts, initial codes developed included ‘movement description’, ‘postural stability’, ‘active posture’, ‘assessment and treatment of a movement component’ and ‘analysis of movement performance’. These codes were initially grouped under categories titled ‘Postural
Control/Stability’, ‘Integration of movement’ and ‘Selective Movement / Mobility’. Further analysis and interpretation of this data led to the theme of ‘Movement – the integration of postural control (stability) and selective movement (mobility)’ (Figure 2-1 Development of the Theme – Integration of Postural Control and Selective Movement p.24).

4.5. Results

Twenty-two Full IBITA members volunteered to participate in the study over the four locations. Thirteen were Basic instructors, 6 Advanced and 3 were Senior instructors.

The participants presented a range in clinical experience from twelve to forty years, and number of years as an IBITA instructor from one to thirty-five years. The educational background ranged from twelve instructors with graduate diploma’s in physiotherapy, seven instructors with a masters degrees, and two instructors with doctorate degrees. Sixteen instructors were involved in academic teaching at the entry to practice level and the approximate amount of time spent in direct patient care versus instructing Bobath continuing education courses ranged from 90:10 to 25:75. The instructors who volunteered to participate were from the following countries: Australia, Spain, Italy, UK, Canada, Germany and Belgium (Table 4-3 Summary of Participant Demographics p.89).

This paper is drawn from data from a larger program of research examining clinical reasoning and core treatment themes of expert Bobath therapists. In this paper we present the findings as to how the therapists conceptualize movement as they work with clients with neurological conditions. The conceptualization of movement by the participants involves the following elements:

- Movement comprises the whole person, the whole body, not just individual body segments. Sensory information influences movement. Movement is dependent upon the individuals lived experiences.

- Alignment is integral to movement performance.

- Movement is the relative integration of postural control / stability and selective movement / mobility.
Postural control / stability is active, selective and underpins efficient selective movement / mobility.

Selective movement / mobility is the ability to limit the degrees of freedom of movement enabling specific movement at a specific body segment/s.

Each element will be discussed individually, however in clinical practice each element is integrated seamlessly such that the whole is greater than the sum of the individual elements.

4.5.1. Movement comprises the whole person, the whole body, not just individual body segments. Sensory information influences movement. Movement is dependent upon the individuals lived experiences.

The participants embraced a humanistic approach to their clients recognizing that a neurological lesion or condition impacts how the whole person moves within the context of their environment.

The person and the body

The participants considered movement from the perspective of the whole person, not just as a body with movement dysfunctions. The participants considered their clients’ body language and facial expressions, how they responded to questions, and the information they chose to share – allowing them to understand what movement means to the person in order to build rapport in a therapeutic relationship. As one explains,

“It’s not only the body, it’s the human being, to talk with him and see about the face and his impression and what he’s saying” (Participant #17: Pamela)

They draw upon the whole experience of the clients, their cognition and perception, considering the clients’ attention, concentration, understanding, postural orientation and possible neglect of body segments with respect to motor behavior, insight, retention, carryover and therefore movement potential. This is described by a participant as she works with her client, a seventy year old man one year post right hemorrhagic cerebrovascular accident (CVA),

“I think these neuropsychological problems of attention, concentration and neglect of this left side also contribute to his current state” (Participant #4: June)
**Whole body vs. body segments**

The participants were interested in the movement of the whole body not just the more affected body segments. They also considered aspects of the clinical presentation from a broader perspective than movement of isolated body segments,

“... also to the breathing, the coordination of the breathing, and speech which I am also listening to is the patients words and answers that they give” (Participant #20: Rachel)

They were interested in how their clients were moving their bodies in functional activities and how this movement was incorporated into their daily lives, as illustrated by the following comment,

“It was really important for me to see him walking because through this function I can understand which are the weakest points and the compensations in this movement, his functional movement in walking and the possibilities in his daily life to walk” (Participant #9: Larry)

Movement of the body segments that were less affected were equally as important as the body segments that were more affected. Most important was how movement of all body segments was incorporated together into function. As one comments,

“It’s not unusual that I would be interested in how the patient would be able to stand on their less affected leg because many patients don’t present as just hemiplegic” (Participant #11: Fiona)

The influence of sensory information on movement is a key feature of the participants’ conceptualization of movement. The participants consider the influence of sensory information on movement from multiple aspects. As one describes,

“The (sensory) information that he is potentially able to access, the (sensory) information that he can gain through his vestibular system, through joint information and muscle activity, to enhance his extension against gravity” (Participant #2: Stefanie)

Whilst another discusses the influence of sensory information from the environment and hand contact on her client’s perception of verticality,
“I like to have her hands as a frame of reference within the environment (hand contact on a treatment bed) because they are a part of what helps her create the verticality” (Participant #18: Sarah)

**Movement is dependent upon the individual’s lived experience**

**The Client’s Movement Expectations**

The participants considered how the clients would like to move, in order to inform the goals of the clinical session as well as longer-term rehabilitation goals. One participant’s client identifies a specific functional activity and a specific problem that he was encountering,

“... he wanted to improve his leg for walking and for stairs and he said that he specifically has some trouble with going downstairs” (Participant #3: Tabatha)

Whereas another client’s goal was to reduce his effort required for walking,

“He’s telling me that his needs are to walk and to not get so tired while walking” (Participant #5: Ben)

Whilst another client, who is currently living in a residential care facility, informs his therapist of his long term goal,

“He has a goal of him being home alone independently” (Participant #2: Stefanie)

**Movement experiences pre and post the neurological lesion**

The participants considered the client’s movement experiences from both before and following the neurological lesion, illustrated in the following statement,

“I asked him a little bit about his work because I wanted to know what his background mobility was like which also helped me to know what his expectations might really be” (Participant #1: Jenny).

The participants consider how the individual is moving today as dependent upon the individual’s movement experiences prior to and following the neurological lesion. Therefore, how the person moved before their lesion, how they move now and how they move tomorrow are inter-related
and have consequences on a structural and functional level. This is illustrated by a participant considering the impact of her client’s learned non-use,

“… it’s important because it’s really linked with the learned non-use of the right side and the loss of representation of the right side of her body, and also the over-use of the left side, the only thing that exists for her is the left side” (Participant #10: Mara)

The participants consider factors such as occupation, pre-morbid activity level, leisure activities, goals, and use of assistive devices on their client’s movement strategies whilst simultaneously considering the neural and neuromuscular consequences of movement. A participant illustrates this point as she discusses the impact of her client’s dominant use of his less affected upper limb with a crutch on his upright posture,

“I wanted to see if I could modulate the way he was using his right arm, the amount of pressure and flexion into the crutch, to see if I could actually not challenge him too much by taking the crutch away but see if I could change the way he used it” (Participant #11: Fiona)

### 4.5.2. Alignment is integral to movement performance

Alignment is a key component of the participant’s conceptualization of movement performance. When the participants talk about alignment they consider not only the biomechanical arrangement of the body segments but the neuromuscular activation creating the alignment, the posture, and the sensory information arising from the alignment. They consider the relative relationship of body segment/s, the postural alignment, with the base of support and gravity, and how these aspects may influence movement performance in particular weight transfer. As one describes,

“When he is standing his (left) shoulder is up and backwards so it is going to be difficult for him to follow the movement and transfer the weight to the left with this relationship and alignment of the shoulder” (Participant #3: Tabatha)
Alignment influences postural control

Alignment is an integral aspect in the participant’s conceptualization of movement with respect to the development of postural control, particularly in respect of anticipatory postural control. The participants use their knowledge of the relationship of body segment/s alignment, and thus the sensory information arising from alignment, on the production of anticipatory postural adjustments, illustrated by the following comment,

“I want to know the alignment of the body parts relative to each other because I want to influence them, because that will then influence her ability to generate some sort of postural stability” (Participant #18: Sarah)

Alignment influences whole body movement

The participants consider the alignment of body segment/s with respect to whole body movement. The impact of alignment of a body segment/s on the ability of the client to generate selective movement in another body segment is illustrated in the following comment,

“Its striking me the alignment of the left shoulder complex, I would like to get in there and see if I can realign that shoulder girdle to see if that makes her left leg any different in terms of her walking pattern” (Participant #19: Holly)

Alignment that optimizes stability and mobility

The participants consider optimal alignment as maximizing postural stability of a body segment/s in order to facilitate selective movement in another body segment/s. As one describes,

“I wanted to optimize the activity and see what his potential activity was in the upper limb, I needed to know that he was in an alignment that was conducive to that and that he was supported appropriately in the base of support” (Participant #1: Jenny)

Quality of movement performance

Quality of movement performance, the movement components and strategies used, is integral to the participant’s conceptualization of movement and forms the basis of their movement analysis. When participants talked about the quality of movement performance they were not just
considering whether the client could complete an activity or task, rather they considered how their clients performed activities and the movement strategies they used when they walked, transferred and undressed. As one said,

“I was interested in not just what he was doing but how he was doing it” (Participant #3: Tabatha)

Whilst another relates the quality of movement performance to neuromuscular plasticity,

“The quality of movement is important because whatever the movement is that you are doing is what you are plastically adapting to” (Participant #1: Jenny)

**Typical vs Atypical movement**

The participants compared their client’s current movement strategies to their knowledge and understanding of typical motor behavior, as one explains,

“I’m comparing it with one side to the other, also comparing it relative to other patients and to people who don’t have a central nervous system lesion” (Participant #6: Angele)

The participants considered qualitative aspects of movement from both a visual and tactile perspective, as one comments,

“Where does it start the movement, the pattern, the trajectory, the coordination, the orientation, the weight of the limb for example” (Participant #17: Pamela)

**4.5.3. Movement - the relative integration of postural control (stability) and selective movement (mobility)**

The participants consider postural control and selective movement as inseparable and interdependent. The active alignment of body segments is a key component of both postural control and selective movement. The participants discuss the movement’s postural control element/s as the stability component, and the selective movement element/s as the mobility component. For the participants there is an interactive relationship between postural control (stability) and selective movement (mobility) with respect to the client’s movement performance. As one explains,
“It always starts for me in deciding whether the person has got a primary postural problem or a primary movement problem and what’s the relative relationship between those two” (Participant #16: Leslie)

The participants apply the concept of the interactive nature of postural control (stability) and selective movement (mobility) from the perspective of the whole body/multiple body segments e.g., keep trunk stable to selectively move upper limb, to individual body segments e.g., keep scapula stable to selectively move the gleno-humeral joint. This is illustrated by the comment,

“I am using movement in one body segment/part to affect stability in another body segment because I think the stability in that body segment is going to help me with movement in other body segments” (Participant #8: Jimmy)

**Efficiency of movement**

For every task or postural transition the participants have an expectation of the changing relationship of postural control and selective movement such that weight transfer is appropriately controlled, whilst also considering base of support and gravity, illustrated by the comment,

“I particularly noted the pattern that she used to take her shoes and sock off, her left leg over her right (leg) was really really inefficient, she did not transfer her weight to the right to do it” (Participant #7: Rosie)

The participants consider movement efficiency as the combination of being able to move selectively and the ability to momentarily stop selective mobility such that weight transfer is appropriately controlled with respect to the base of support and gravity.

Participants considered the relative efficiency of the interaction of postural control and selective movement based on their knowledge of human movement. Selective movement (mobility) is the ability for the client to move one body segment or segments on the background of appropriate postural control (stability) and is described by one,

“Efficiency is being able to move selectively, being able to you know have choice about the movement, being able to have sufficient postural stability to be able to limit the degrees of freedom so I move the body part I want to move on the background of the rest of the body not
being an interference actually being a support to that movement, and so many ‘normal’ models can move, can function perfectly well, but they’re not moving as efficiently as they could” (Participant #11: Fiona)

In contrast, inefficient stability is described as ‘fixation’, motor behavior that is static and unchanging,

“Fixation is to hold a body part still and static so that you can move other body parts around it” (Participant #16: Leslie)

4.5.3.1. Postural control (stability) is active, selective and underpins efficient selective movement/mobility

The participants consider postural control as the orientation and active alignment of body segments with respect to the base of support and gravity. They do not consider postural control to be static or inert, rather, it is dynamically flexible, as one describes,

“I am looking for an output and I want this output to be selective and anticipatory in the trunk” (Participant #9: Larry)

Whilst another comments that it’s not just the posture of standing but the underlying muscle activity that is creating the standing posture,

“The verticality to me isn’t just a position but it’s the muscle activation that’s creating it” (Participant #18: Sarah)

Selective postural control is the foundation for selective movement

The ability to develop a sufficient postural background on which selective movement can be performed i.e., the ability to keep the appropriate body segment/s stable so that another body segment/s can move selectively, is a critical foundation of movement from the participant’s perspective. As one participant says,

“My observation early on was that he didn’t have appropriate postural control to elevate either arm and so that every time he tried to move an arm he got inappropriate anticipatory postural activity and so I needed to start there to give him some sort of basis before I could really influence the upper limb activity” (Participant #1: Jenny)
The active development of postural control is considered an essential element of movement. Postural stability is considered a composition of selective movement elements with respect to the base of support and gravity and forms the postural background on which selective movement is based. As one comments,

“It’s very very important for me how she gets down into supine, it must be as active as possible in order that her anticipatory postural mechanisms are challenged maximally to keep symmetrical activity throughout all four limbs and through the trunk” (Participant #16: Leslie)

The creation of an active posture, whilst simultaneously considering the influence of the base of support and gravity, allows selective movement within the developed posture, described as follows,

“Taking him to a situation (supine) where I eliminate some of the interference factors (instability in sitting and standing), I can then get a clearer idea of the selective movement patterns available in the right leg, and the left leg, how they integrate, and then put that integration into standing as a foundation for a better trunk” (Participant #11: Fiona)

4.5.3.2. Selective Movement (mobility) – the degrees of freedom problem

Sequencing of selective movement – movement patterns

The patterns of movement that the client’s use, the timing and spatial organization of selective movement components, are fundamental elements of the participant’s conceptualization of movement with respect to task performance and task practice. As one comments,

“She has got the rhythm for gait but the right leg has got some difficulties to be engaged in a really good rhythmic activity with the left leg” (Participant #14: Celia)

The participants may choose to address a specific movement component within a movement pattern to address task performance. As one describes,

“To improve the way she does the task we need to work on certain (movement) components and then we have to put them all together for the task” (Participant #8: Jimmy)
Or, the participants may use task practice to influence a movement component/s within a movement pattern,

“I want to use the stand to sit and the sit to stand activity to build the (movement) components that are in this activity, for instance to have extension in the hip, to have stability in the distal quads, to have more weight on the foot and to have extension in the trunk” (Participant #5: Ben)

Variability in movement patterns

Movement patterns are composed of selective movement components. For movement to be selective and variable, and therefore efficient, an adequate postural background, or stability is required. The ability to only use one movement pattern is considered an inefficiency of movement, thus variability of movement patterns implies a greater degree of movement selectivity. As one said,

“I want to change that pattern because I am wanting to have patterns of movement that are variable, so I want her to be able to use as many patterns as possible, but at the moment she can only use one pattern and I want to change that pattern because that pattern is going to influence the functionality of the task” (Participant #8: Jimmy)

Variability in movement patterns is also considered with respect to movement of the less affected body segments vs. movement of the more affected body segments. Over-use of the less affected body segments, due to a lack of variability, is referred to as ‘compensatory movement’ as one describes,

“They have a lack of posture and selective movement and they have to go to more compensatory strategies, that means over-activating the less affected side” (Participant #17: Pamela)

4.6. Discussion

The purpose of this paper is to illustrate how a group of neurological therapists, IBITA instructors, conceptualize movement. The key findings of this study are: 1) Movement is conceptualized from a person-centred perspective, influenced by sensation and dependent upon
the person’s lived experience; 2) Alignment is a key aspect of the quality of movement performance; and, 3) Movement is the relative integration of postural control / stability and selective movement / mobility. This paper will discuss the study’s results with respect to physiotherapy theories.

4.6.1. Movement – A Humanistic Approach

Movement is considered a core aspect of physiotherapy (PT) practice and therefore integral to the clinical reasoning process, but has not been extensively debated or developed in the PT profession (Hislop, 1975);(C. A. Cott et al., 1995);(C. A. Cott & Finch, 2007);(Sahrmann, 2014);(Wikstrom-Grotell & Eriksson, 2012). The focus of the evidence-based practice research lens on the development of scientific/propositional knowledge supporting PT interventions has left the theoretical landscape of PT and professional practice knowledge on which PT practice is based bereft (Wikstrom-Grotell & Eriksson, 2012). Thus, the conceptualization of movement, including the role of the body, from a PT perspective remains primarily implicit knowledge (Nicholls & Gibson, 2010);(Øberg et al., 2015).

An assumption and central concern of PT embedded within the World Confederation of Physical Therapy (WCPT) description of PT states that movement is essential, purposeful, and influenced by internal and external factors (WCPT, 2011). Consistent with the ‘Movement Continuum Theory’ (MCT), WCPT (2011) states that physical, social and environmental factors have the capacity to influence the individual’s movement (WCPT, 2011);(C. A. Cott et al., 1995). Likewise, Skjaerven et al (2008) suggest that movement comprises global and elemental aspects, supporting the consideration of perceptual and cognitive influences on movement (Mulder, 1991);(Di Pino et al., 2014) as well as more tangible elements such as speed and strength (Skjaerven et al., 2008).

Similarly, the IBITA instructors consider movement from a whole person, whole body perspective such that clients were considered in their entirety from a cognitive, perceptual, functional and contextual perspective. The IBITA instructors conceptualized movement from micro to macro-perspectives, considering plastic adaptation of the neuromuscular system to the influence of the person’s sociocultural roles. They considered the pre-morbid body and person not just the body and person affected by the neurological condition, thereby recognizing the influence of the person’s lived experience and thus influence of sensory information on
movement. This clearly extends beyond a pathokinesiological approach to movement (Hislop, 1975).

The IBITA instructors considered how their client’s were currently moving within the context of work, leisure, and family roles, as well as how they would like to be moving, establishing goals and expectations of rehabilitation in order for the clinical sessions to be meaningful and goal directed. This is consistent with the MCT with respect to ‘Current Movement Capability’ (CMC) and ‘Preferred Movement Capability’ (PMC) (C. A. Cott et al., 1995).

The IBITA instructor’s acknowledgement of the influence of the sociocultural context, the cognitive, and perceptual aspects of movement, the importance of developing a therapeutic relationship and the influence of sensory information on movement are consistent with the embodied interactive model of clinical reasoning described by Oberg et al. (2015). These aspects of neurological clinical practice are difficult to research and quantify, but acknowledgement of their potential to affect movement outcomes is required.

In contrast the ‘Human Movement System’ (HuMS) proposed by the American Physical Therapy Association as the fundamental system of physical therapy (Sahrmann, 2014) is focused on a physiological organ system as it relates to pathokinesiology, kinesiopathology and a distinction between normal and abnormal movement. Although Mrs. Bobath used the terminology ‘normal’ and ‘abnormal’ movement in her publications (Bobath, 1970); (Bobath, 1978); (Bobath, 1990), IBITA recently adopted the terminology typical, atypical and compensatory movement to more appropriately describe movement problems (Vaughan-Graham & Cott, 2016 (in press)); (M F Levin & Panturin, 2011); (Mindy F Levin et al., 2009). This movement classification is critical to IBITA instructor’s conceptualization of movement particularly with respect to the analysis of movement quality.

Likewise, the focus on pathological movement, or movement pathology (Sahrmann, 2014), does not address the movement problems faced by persons with neurological conditions as conceptualized by IBITA instructors. Perhaps this is because the HuMS was developed from a musculoskeletal framework which is more amenable to a physiological systems approach. Whereas neurological pathology is remote from the movement problem. The therapist is neither treating the neurological pathology directly, nor pathology arising from movement, unless secondary musculoskeletal issues develop over time. Lastly, how sociocultural and economic
influences impact on the person, the body and thus movement is not explicit within the HuMS (Sahrmann, 2014). The HuMS focus on physiological systems perpetuates a one sided mechanistic view of the human, whilst ignoring the essential humanistic perspective of person-centred care embraced by the IBITA instructors (Miles & Loughlin, 2011). This potentially limits the remit of PT in the areas of wellness, prevention, chronic illness and societal reform and undervalues the role of personal knowledge underpinning clinical practice (Miles & Loughlin, 2011).

The IBITA instructors conceptualize movement from a humanistic perspective, considering the person and the body with respect to movement dysfunction. Movement is conceptualized as a lived experience influenced by multiple aspects. Therefore, movement dysfunction as a result of a neurological condition is a complex life-long movement issue requiring a person-centred approach in order to maintain overall health.

4.6.2. Movement performance – the relative integration of postural control / stability and selective movement / mobility

Movement performance, or the dimensions of movement, critical to its conceptualization in PT practice have received even less debate than PT theories of movement (Allen, 2007); (Skjaerven et al., 2008). The interaction of postural control (stability) and selective movement (mobility) with alignment and variability as key components, are integral to the IBITA instructors’ conceptualization of movement. They describe postural control as the selectively active alignment and orientation of body segments. This is consistent with a recent Delphi study of IBITA instructor’s in which postural control is identified as an aspect of the conceptual framework underpinning Bobath interventions and is viewed as,

“The organization of stability, mobility and orientation of the multi-joint kinetic chain, which is reflective of the individual’s body schema in order to maintain, achieve or restore a state of equilibrium during any posture or activity”. (Vaughan-Graham & Cott, 2016 (in press))

This is consistent with ‘Posturo-Kinetic Capacity’ theory (Yiou, Caderby, & Hussein, 2012), and the view of the human body as a multi-joint kinetic chain in which stability and mobility of body segments are coordinated for the maintenance of equilibrium (Hodges, Gurfinkel, Brumagne,
Smith, & Cordo, 2002), with respect to gravity, internal references and base of support (Horak, 2006).

The relative interaction of postural control and selective movement, which the IBITA instructor’s discussed synonymously as the interdependence of stability and mobility, is a key movement concept for IBITA instructors. The person’s ability to limit the degrees of freedom to enable the desired selective movement required for maintenance of equilibrium and task performance is critical to their understanding of movement. This is consistent with the neuro-scientific literature on the production of feedforward / anticipatory postural adjustments (Santos, Kanekar, & Aruin, 2010a);(Santos, Kanekar, & Aruin, 2010b);(Krishnan, Aruin, & Latash, 2011) and anticipatory synergy adjustments (Klous, Mikulic, & Latash, 2011), such that postural perturbations are attenuated to optimize movement.

The concept of anticipatory control has been investigated in the sports science and orthopedic literature specifically with respect to the role of core stabilization improving distal motor performance (Kibler, Press, & Sciascia, 2006);(Ayhan, Unal, & Yakut, 2014). However, surprisingly the concept of requiring and developing a sufficient level of postural background activity i.e., to be able to limit the degrees of freedom (Bernstein, 1967), to influence the quality of movement performance has garnered limited attention in neuro-rehabilitation research (Michaelsen, Dannenbaum, & Levin, 2006);(Karthikbabu et al., 2012).

Interestingly, the Bobath concept demonstrated superiority in the domain of balance control in a recent best evidence synthesis (Kollen et al., 2009). Balance recovery in persons post-stroke is an indicator of functional independence (Cabanas-Valdés et al., 2015);(Di Monaco, Trucco, Di Monaco, Tappero, & Cavanna, 2010), and is also correlated with the individual’s trunk control (Jijimol, Fayaz, & Vijesh, 2013);(Liao, Liaw, Wang, Su, & Hsu, 2015). Despite limited clinical applicability and effectiveness neuro-rehabilitation research has focused on upper limb (Corbetta, Sirtori, Castellini, Moja, & Gatti, 2015);(Viana & Teasell, 2012) and lower limb interventions (Wessels, Lucas, Eriks, & de Groot, 2010);(Middleton et al., 2014);(Dobkin & Duncan, 2012) whilst the role of the trunk and postural control with respect to upper and lower limb interventions and in overall motor recovery and has received far less attention, not to mention the role of the person and society (Chen, Lee, & Aruin, 2015);(Pereira et al., 2014);(Newitt, Barnett, & Crowe, 2016).
Alignment, or body configuration, is identified as a key component of IBITA instructor’s conceptualization of movement and has been identified in the neuroscience literature as influential in the production of feedforward / anticipatory postural control (Tomita et al., 2011); (Caronni & Cavallari, 2009); (A. Aruin, 2006). Thus the influence of alignment on the acquisition of postural control and therefore movement recovery in persons with neurological conditions requires further investigation (Chen et al., 2015).

The IBITA instructors consider variability in movement patterns as a key aspect of their conceptualization of movement. Allen (2007) proposed six dimensions of movement, flexibility, strength, speed, accuracy, adaptability and endurance, within the construct of the MCT. In a recent Delphi study IBITA instructors’ identified similar dimensions including ease, rhythm, coordination, specificity, variability, repeatability and speed (Vaughan-Graham & Cott, 2016 (in press)). Not surprisingly, reduced muscle coordination complexity and locomotor performance has been identified in persons with neurological conditions in the neuroscience literature (Clark, Ting, Zajac, Neptune, & Kautz, 2010); (Safavynia, Torres-Oviedo, & Ting, 2011); (Hayes, Chvatal, French, Ting, & Trumbower, 2014); (Sousa, Silva, Santos, Sousa, & Tavares, 2013). Therapists are therefore considering qualitative aspects of movement such as coordination, adaptability, variability, accuracy and repeatability, and persons with neurological conditions are demonstrating reduced muscle coordination complexity in movement performance. This suggests that movement dimensions such as muscle coordination complexity should be considered when investigating neuro-rehabilitation interventions. Additionally, which movement dimensions are important to clinicians and persons with neurological conditions requires investigation (C. A. Cott & Finch, 2007).

4.7. Conclusions

This study has identified that IBITA instructor’s conceptualize movement from a person-centred perspective consistent with the Movement Continuum Theory (C. A. Cott et al., 1995). Therefore, inclusion of a humanistic perspective is necessary in forming the knowledge base underpinning neurological rehabilitation. The integration of postural control and selective movement, with alignment and variability as key components, form the foundation of IBITA instructor’s understanding of movement. However, the role of postural control in movement recovery post CNS lesion requires further investigation. Movement dimensions critical to the
conceptualization of movement are not well understood from the perspective of the clinician or persons with neurological conditions. Therefore, this is an area of physiotherapy practice requiring further exploration. However, neuroscientific evidence supports the role of alignment and muscle coordination complexity in movement and therefore these movement dimensions require consideration in neuro-rehabilitation effectiveness studies.
Table 4-1 Participant Inclusion Criteria

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<td>• A Full member of IBITA</td>
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<td>• Registered as a physiotherapist in the jurisdiction that they practice and the research location</td>
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<td>• Proof of current Professional Indemnity Insurance Certificate</td>
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Figure 4-1 Participant Recruitment Process
Figure 4-2 Patient Selection and Recruitment Process
Table 4-2 Patient Selection Criteria

<table>
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<th>Patient Selection Criteria</th>
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<tbody>
<tr>
<td>The client will have sustained a lesion of their central nervous system</td>
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<tr>
<td>The client is able to be facilitated into single leg standing on the less-affected lower limb, and, within their stability limits, perform a reaching activity with the less-affected upper limb</td>
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<td>Duration of impairment is to be &gt; one year</td>
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<td>Aged between 20-70 years</td>
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<td>Capacity to independently consent to participate in this research study</td>
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Table 4-3 Summary of Participant Demographics

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### Table 4-4 Summary of Patient Demographics

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Chapter 5
The Role of Professional Practice Knowledge in the Clinical Reasoning of Expert Bobath Instructors

Vaughan-Graham J & Cott C.

Prepared Manuscript

5.1. Introduction

Clinical reasoning is how the clinician manages the complexity, uncertainty, instability and uniqueness of clinical practice (Schon, 1983). Clinical reasoning has been described as a ‘vital skill’ for the therapy professions (Leicht & Dickerson, 2002) as the reasoning process determines if a specific intervention is relevant, reasonable and appropriate in the individual client’s presentation and context (Fish & Higgs, 2008). The utilization of knowledge, both theoretical and clinical, and its integration into clinical practice is dependent upon experience (Rassafiani, Ziviani, Rodger, & Dalgleish, 2009); (Hicks et al., 2003), the organization and structure of knowledge, as well as it being efficiently retrievable (May, Withers, Reeve, & Greasley, 2010; Noll et al., 2001). Not surprisingly, the bodies of literature related to clinical reasoning and clinical expertise have evolved concurrently, indicating the interdependence of these two aspects relative to clinical practice (Joy Higgs & Mark Jones, 2000) (G. Jensen, Resnik, & Haddad, 2008).

Rehabilitation sciences research over the past decade has focused on defining interventions in order to test their efficacy (Costa et al., 2011), situated within the doctrine of ‘Evidence-Based Practice’ (EBP) (Loughlin et al., 2012); (Hibbert, 2012). EBP is concerned with generalizations and probabilities i.e., the probability of an intervention working for a described population, whilst eliminating bias (Hutchison & Rogers, 2012). Generalizable knowledge however is insufficient for professional practice as professional practice is concerned with particulars, the individual within a specific context (Hibbert, 2012).

The role of clinical reasoning in professional practice, the understanding of ‘why’ a therapist chooses a particular intervention, including attention to technical competence and expertise has
been sadly lacking (Page et al., 2012); (Nicholls & Holmes, 2012); (Verheyden et al., 2011), and largely ignored in the current rehabilitation sciences evidence base (Kristensen et al., 2012); (Holdar, Wallin, & Heiwe, 2013) with an accompanying under-development of the theory underpinning the clinical reasoning process (Ian Edwards et al., 2004); (Greasley, May, Reeve, & Withers, 2008).

Thus the dominant discourse in the health professions has been immersed in scientific approaches, or instrumentalist rationality, with a simultaneous demise of value-rationality, resulting in an ever-widening theory-practice gap and no consensus on how to remedy the situation (Loughlin et al., 2012); (Kinsella & Pitman, 2012). The understanding of clinical reasoning is central to professional accountability and autonomy, and is therefore the very essence of evidence-based practice (Bartlett & Palisano, 2002); (Ajjawi & Higgs, 2008); (Wainwright et al., 2011).

Neurological conditions have significant personal, financial and economic costs with stroke and traumatic brain injury being major global health problems in terms of disability and socioeconomic burden (Krueger et al., 2015); (Bragge et al., 2012); (Wissel et al., 2013). The Bobath concept, referred to as ‘NeuroDevelopmental Therapy’ (NDT) in the American literature, is one of the most widely used neuro-rehabilitation approaches (Vaughan-Graham et al., 2015b). A hallmark of the Bobath concept is its interaction between assessment and treatment (Bobath, 1990) with an emphasis on the complex clinical reasoning process enabling a continuously evolving treatment, response-based to the client and context (Johnson, 2009); (C. Cott et al., 2011). It therefore provides an excellent model for understanding clinical reasoning in neurological practice. The purpose of this study is to explicate the clinical reasoning process of this widely used neuro-rehabilitation approach.

5.2. Research Background

5.2.1. Clinical Reasoning and Clinical Expertise

Clinical reasoning is a complex, iterative, client centred process dependent upon the integration of theoretical knowledge and professional practice experience in the context of the clinical setting (Megan Smith, Joy Higgs, & Elizabeth Ellis, 2008); (Ian Edwards et al., 2004). It is considered a core competency of health professional education and an essential aspect of
effective clinical practice (Cruz et al., 2012b). The literature suggests that there is a clear difference in how novice and expert practitioners practice predominantly due to their clinical reasoning abilities (G. M. Jensen et al., 1990); (G. Jensen et al., 2008); (Wainwright et al., 2010); (Wainwright et al., 2011); (Carrier et al., 2010); (Rassafiani et al., 2009), specifically in the knowledge they hold and in the way they interact with their patients (Shepard et al., 1999); (Unsworth, 2001); (Wainwright et al., 2011); (May et al., 2010).

Mattingly & Fleming (1994) provided formative work on clinical reasoning strategies of occupational therapists identifying four clinical reasoning strategies: (i) Procedural (hypothetical); (ii) Interactive; (iii) Conditional; and, (iv) Narrative (Mattingly & Fleming, 1994). Edwards et al. (2004) expanded on previous work suggesting that physical therapists combine hypothetico-deductive, instrumental, narrative and communicative reasoning strategies dialectically, proposing a dynamic interplay between different knowledge sources and reasoning strategies used within a clinical encounter (Ian Edwards et al., 2004).

5.2.2. Clinical Reasoning and Knowledge

The knowledge that clinicians bring to the clinical encounter is a primary feature of the therapeutic intervention (G. M. Jensen et al., 1992), and this knowledge takes three forms: a) Propositional (scientific) knowledge; b) professional practice knowledge (knowing how to do something); and, c) personal knowledge (accrued from life’s experiences) (Higgs & Titchen, 2001). It has been identified that it is the cognitive development of the individual clinician that facilitates knowledge use (in the broad sense) in clinical practice and also enables knowledge generation through clinical practice (Christensen et al., 2008). However clinical reasoning requires declarative (propositional) knowledge, as well as procedural (knowing how) and conditional (knowing when) knowledge, in other words, practical wisdom or phronesis (Michels, Evans, & Blok, 2012). To date, the practical wisdom or phronesis that a therapist develops through clinical experience and how this contributes to the clinical reasoning process has received little attention in the literature (Nicholls & Holmes, 2012). Expert clinicians apply theory in a variety of ways in order to make it useful to particular patients, in their specific situations, as well as generating new knowledge in the form of practice principles (Carrier et al., 2010); (Higgs & Titchen, 2001). A core feature of the expert clinician is their ability to combine knowledge with experience, to know what is important, and to recognize and appreciate the
significance of critical cues (Kristensen et al., 2012); (Wainwright et al., 2011); (Megan Smith et al., 2008); (Mitchell & Unsworth, 2005); (G. M. Jensen et al., 1990).

To date conceptual reasoning frameworks remain relatively general to the practice of therapy (Ian Edwards et al., 2004); (Schenkman et al., 2006); (Wainwright et al., 2011), suggesting that research is needed to explore the clinical reasoning process of expert clinicians in specialty areas (Noll et al., 2001); (Norman, 2005); (Carrier et al., 2010). Bobath (IBITA) instructors are considered experts in their theoretical and professional practice knowledge with respect to the clinical application of the Bobath concept.

The purpose of this study is to gain an understanding of the clinical reasoning process in expert IBITA instructors, to explicate not ‘what these therapists do’, but ‘how these therapists decide to do what they do’ to gain a greater understanding of the individuality of neurological rehabilitation.

5.3. Research Methodology and Methods

This paper is drawn from data from a larger program of research examining how expert Bobath therapists conceptualize movement and core treatment themes. The research methodology and methods are described in a companion paper (Refer to Chapter Four). In summary a qualitative research approach, Interpretive Description, was undertaken for this study as we aimed to develop discipline-specific knowledge about a complex clinical process (Sally Thorne, 2008)(p.23-51).

The International Bobath Instructors’ Training Association (IBITA) formed the study sample (Table 4-1 Participant Inclusion Criteria p.85). Expert Bobath instructors, recruited from IBITA, were video-recorded during an initial 1.5 hour clinical session with a client immediately followed by a focused interview whilst reviewing the video of their clinical session.

The four study locations were (i) Melbourne, Australia; (ii) Madrid, Spain; (iii) Brescia, Italy; and, (iv) Lisbon, Portugal. Twenty-Two IBITA instructors voluntarily agreed to participate (Figure 4-1 Participant Recruitment Process p.86). The participation of patients was key to the success of the study although they were not the units of analysis. Voluntary recruitment of
patients was facilitated by the clinical facility at each study location (Figure 4-2 Patient Selection & Recruitment p.87) (Table 4-2 – Patient Selection Criteria p.88).

The first author video-recorded one clinical session per IBITA participant, maximum 1.5 hours duration, immediately followed by a video-recorded in-depth focused interview of the IBITA participant, whilst reviewing the video of his/her clinical session (Appendix A p.148). Each research participant was requested to complete a ‘Participant Professional Profile Form’ providing demographic information (Appendix B p.149) (Table 4-3 – Summary of Participant Demographics p.89 and Table 4-4 – Summary of Patient Demographics p.90).

5.4. Data Analysis

The focused interviews were transcribed verbatim by the first author and provided the raw data for the study. The interview transcripts were imported into the NVivo qualitative software program to facilitate the coding and analytic process. Coding was a progressive, iterative process, beginning with labeling segments of the data, then through making comparisons and writing memos the data was reassembled into categories. By continually comparing data from the same research participant, between research participants, comparing categories, and data with categories, whilst simultaneously writing memos to document this process the analysis was taken to successive levels of interpretation.

For example, codes such as ‘current functional level’, ‘patient goals’ and ‘patient expectations’ were grouped under the category ‘Client centred’, whereas codes such as ‘Applied theory’ and ‘Theory’ were grouped under the category ‘Conceptual Underpinnings, whilst other codes such as ‘Postural analysis’ and ‘Quality of Movement’ were initially grouped under the category ‘Analysis of Movement Performance’ which later was retitled ‘Clinical Framework’ (Figure 5-1 Development of the Theme – Bobath Clinical Framework p.109). Other codes such as ‘linking movement problems’, ‘confirming movement hypothesis’, and ‘movement potential’ were grouped together and titled as a category ‘Movement Diagnosis’. Further analysis and interpretation of this data gave way to broader terms such as ‘Pattern recognition’, ‘Constant comparisons’, and ‘Maximum achievable movement potential’ respectively (Figure 5-2 Development of the Theme – Bobath Reasoning Approach p.110). As the analysis proceeded it became apparent that some of the concepts being identified were consistent with the ‘Movement
Continuum Theory of Physical Therapy’ (C. A. Cott et al., 1995) such that ‘Current movement capability’, Preferred movement capability’ and ‘Maximum achievable movement potential’ were illustrated in the data (Figure 2-2 Development of the Theme – Person Centred p.25)

5.5. Results

Twenty-two Full IBITA members volunteered to participate in the study over the four locations. Thirteen were Basic course instructors, 6 Advanced course instructors and 3 were Senior instructors. The participants presented a range in clinical experience from twelve to forty years, and number of years as an IBITA instructor from one to thirty-five years. The educational background ranged from twelve instructors with graduate diploma’s in physiotherapy, seven instructors with a masters degrees, and two instructors with doctorate degrees. Sixteen instructors were involved in academic teaching at the entry to practice level and the approximate amount of time spent in direct patient care versus instructing Bobath continuing education courses ranged from 90:10 to 25:75. The instructors who volunteered to participate were from the following countries: Australia, Spain, Italy, UK, Canada, Germany and Belgium.

Three primary themes were developed from the data: 1) A Bobath Clinical Framework; 2) Person Centred; and, 3) A Bobath Reasoning Approach. Each theme contributes a unique aspect to the participant’s clinical reasoning process. It is the inter-related nature of each of these themes that enables the participant to sift through the clinical presentation, piecing the relevant components together to form an understanding of the individual person’s movement problems such that intervention can follow a systematic yet individualized plan.

The data presented here are part of a larger study of the clinical reasoning process of expert IBITA instructors. These data illustrate the role of practical wisdom in the clinical reasoning process permeating each of the three themes identified.

5.5.1. Bobath Clinical Framework

The theme ‘Bobath Clinical Framework’ developed from the data as the IBITA instructor’s described how they use and apply theory as well as their clinical experience and handling skills to interpret the clinical presentation. As the coding structure developed and were reassembled into categories it became apparent it was congruent with the conceptual statements and key aspects of clinical practice identified in the Bobath Clinical Framework, which has been
described in depth in a previous paper (Vaughan-Graham & Cott, 2016 (in press))(Figure 5-1 Development of the theme – Bobath Clinical Framework p.109).

This framework lays the foundation on which the participants base their understanding of the individual clinical presentation guiding their data collection, movement analysis, synthesis, and interpretation of the individual clinical presentation whilst enabling the development of an individualized intervention program which is being formatively evaluated, updated and refined on an iterative basis. This implicit understanding of the Bobath concept is described as follows,

“ The Bobath concept it gives me that frame of reference, I might discover as I do, I might not get it right, I might not make the right decision first off all the time, but I have a clear frame of reference of what I am trying to achieve and a rationale behind how I might begin to achieve it, and a frame of reference of how I might evaluate if we’re heading in that direction or not” (Participant#18: Sarah)

Each clinical session is guided by the participants’ theoretical knowledge, how they apply and interpret that knowledge combined with their clinical skills as the basis of their clinical reasoning and development of an evolving individualized treatment program, as one indicates,

“ The knowledge that I have about the nervous system is absolutely invaluable in terms of developing my clinical reasoning and my treatment program” (Participant #16: Leslie)

Whilst another comments,

“ The neurophysiology informs my practice but it is much more about applying neurophysiology into understanding how the patient’s deficits present so you have to have a particular knowledge of particular systems so that I can for example hypothesize with respect to the patient” (Participant #11: Fiona)

The participants specifically described how within the Bobath concept sensory information is used to inform their clinical reasoning process from the perspective of: a) the person (client); b) the client’s body/movement; c) the therapist (IBITA instructor); and, d) assessment and treatment as an interactive iterative process. Facilitation, including handling skills, has been identified as a key aspect of Bobath clinical practice (Vaughan-Graham & Cott, 2016 (in press));(V Graham et al., 2009). As one describes for her patient, a 58 year old man 1 year post
CVA with significant perceptual and movement problems, how manipulation of the environment has the potential to influence orientation and perception:

“When I was standing behind him I was having to give him quite a lot of orientation just to even get him to move his right arm backwards and forwards...possibly I would have worked with him in a slightly more contained environment even in the corner of the room where I could have brought him into a situation where he would feel completely safe” (Participant #11: Fiona)

The participants also considered the alignment of body segments, the afferent information related to the alignment, and how this impacts on the acquisition of postural control and selective movement as one comments,

“When we saw him standing early on in different situations he never had a knee that was in extension under his hip and over his foot so he couldn’t get the kinetic chain in his left leg to be functional in extension” (Participant #11: Fiona)

Whilst another describes how her assessment through her handling provides her with specific information with respect to her client;

“... feeling relationship of body segments relative to each other, feeling tension, feeling softness or not softness, tension or not tension, and line of pull so either lightness and ease of movement or tension if there is a tension what is the line of the tension what’s the line of pull connecting into as much of the body as you can” (Participant #18: Sarah)

Facilitation is described as being individualized and related to the neurophysiology,

“The therapist must be able to find the right facilitation for this individual, it’s not that there is one facilitation ... it's the change of the pattern, the change in the sensory information, and then the change of the body schema” (Participant #21: Sasha)

Facilitation is more than just therapeutic handling,

“I'm manipulating the environment, the handling, the task, verbal instructions”. (Participant #10: Mara)
Facilitation is a clinical skill developed through professional practice,

“This is technically challenging and so I have to slow down now and really feel my way through it”. (Participant #16: Leslie)

Therefore the process by which the IBITA instructors seek information on the clinical presentation is not only through observation and verbal information and instruction but also through their clinical skills including therapeutic handling, the construction of the treatment environment, how the client responds to the environment, as well as the specific use of verbal cues providing a depth of information on how the client receives, integrates and responds to sensory information thereby informing the clinical reasoning process. The participant’s become a tool in the clinical reasoning process, integrating a visuo-spatial-kinaesthetic perception of the person combined with their cognitive and handling skills, such that both the clients and therapists responses reframe the clinical presentation enabling them to embrace the complexity of each individual situation.

5.5.2. Person-Centred

The individualized nature of the clinical presentation was at the forefront of each clinical interaction. Initial codes were identified for example; history of present condition, past rehabilitation experiences, social history, patient directed movement, patient expectations, considering the whole person and therapeutic relationship. The linkages in the data, within the same participant, and between participants, enabled the development of four categories under the theme ‘Person Centred’: i) Client centredness; ii) Data gathering; iii) Current movement capability; and, iv) Preferred movement capability (Figure 2-2 Development of the Theme – Person Centred p.25).

These four categories are interconnected and inter-related as the IBITA instructor seeks to understand the lived experience of the client from prior to and since their neurological lesion. The participants sought to understand the client from the perspective of the whole person, not just their medical diagnosis or movement problems. This is illustrated by a participant as she began her initial interaction with her client a thirty-two year old male four years post right hemorrhagic CVA,
“...its not only the body, it's the human being, to talk with him and see his facial responses and his impressions and what he’s saying...” (Participant # 17: Pamela)

It was important for the participants to establish a therapeutic relationship at the outset of the clinical session on which to build a collaborative interaction, as one identifies,

“The rapport is really important because its collaborative goal setting and I want her to be an active participant” (Participant #19: Holly)

This collaborative interaction was also illustrated in the category ‘Preferred Movement Capability’ as one comments,

“I wanted to know what was motivational for him to work on so that I was working towards his goals rather than a goal that I might set” (Participant #1: Jenny)

However, the clients stated preferred movement capability was always situated within the participants’ clinical experience, noted by one,

“For her the goal was to use the left arm, that was the verbalized goal, but that wasn’t something that she was going to achieve quickly given her posture and how she was moving when we were talking” (Participant #18: Sarah)

The participants were interested in finding out about multiple aspects of the client’s life from before their neurological lesion, their rehabilitation experiences since their lesion and how their life was currently structured. The questioning was specific to the individual client’s diagnosis and context but revolved around these aspects as one explains,

“I ask information about three big fields, first about her life previous to the stroke so how was her life before in terms of work role with the family so what roles she had what kind of person was she, then I was asking about the stroke because I was interested when it was, where was the location of the lesion and what was the amount of the damage and any medical issues during that time, and then I ask her about how is her life right now such as hobbies, family role, who she is living with, how is her life right now, how does she organize her life right now and the differences between now and before” (Participant #7: Rosie)
The participants’ practical wisdom influenced their clinical reasoning illustrated by a participant as she takes into consideration the motor and perceptual challenges her client experienced with respect to a specific clinical presentation post CVA, ‘Contraversive Pusher Syndrome’,

“From his history five months ago he was pushing significantly and he was extremely challenged as he wasn’t standing upright at all he was only sitting for short time periods because of the over-activity of his less affected side so I was certainly looking for aspects of pushing” (Participant #2: Stefanie)

Likewise, the participants were interested in their clients ‘current movement capability’ based upon their fund of human movement knowledge described as follows,

“It comes from clinical experience and a great understanding of the ‘normal’, I think as an instructor I think one of the huge benefits we have is a lot of experience in ‘assessment and treatment’ and clinical reasoning of non-neurologically impaired individuals which gives you a really clear idea about the variability of ‘normals’ and allows you to make those comparisons between the particular patterns the patient is using” (Participant #11: Fiona)

A participant describes some of the general features she was noting about her client’s gait pattern as he entered the treatment room,

“When he was coming in walking you can see an alteration of stance and swing phase as well as the position and movement of the arm it didn’t move during walking” (Participant #20: Rachel)

Whilst another describes in detail some of the problems she had identified during the clinical session with respect to her client’s movement and muscle activity,

“We have hamstrings that don’t lengthen, a knee that doesn’t go forward in a straight line pathway it goes into adduction, gastrocnemius that is not active enough not producing enough torque to give her enough plantar-flexion, soleus that is too tense to allow her heel to lengthen to the ground and an unstable metatarso-phalangeal arch” (Participant #16: Leslie)
Through this discourse and observation the participants are building a picture of the person and the body’s movement taking into consideration context, against the background of their professional knowledge.

### 5.5.3. Bobath Reasoning Approach

The theme Bobath Reasoning Approach is comprised of five categories: i) Individualized Assessment and Treatment; ii) Critical Cues; iii) Movement Diagnosis; iv) Activity/Task/Posture Selection; and, v) Reflective Practice. (Figure 5-2 – Bobath Reasoning Approach p.110)

The participants did not follow a structured format with every client in the sense that they are gathering data in a stereotypical step by step process, rather they are providing and responding to verbal, tactile and visuo-spatial-kinaesthetic information on an individual, iterative basis which directs further questioning and analysis of specific activities or tasks, as one comments,

“*I am assessing to treat and treating to assess*” (Participant #7: Rosie)

As the clinical interaction progressed the participants began to identify significant aspects of the clinical presentation. A participant describes a non-verbal conversation between her hand and her client’s hand, which she in response perceived as a critical cue,

“*What was quite interesting was very quickly when I started to talk to his hand a little bit more with my hand it became quite easy for his hand to be open and to be placed suggesting that he can integrate sensory information more than perhaps he is doing in the way he’s functioning at the moment*” (Participant #11: Fiona)

The participants gathered and interpreted the clinical data, synthesizing the information, in order to be able to summarize the clinical presentation with respect to their client’s movement, perceptual and cognitive abilities. Through a process of hypothesizing the participants aimed to develop a rationale underpinning a movement diagnosis. A participant describes the formation of her treatment hypotheses as follows:

“*There were two obvious possible hypotheses for me, one, the use of the crutch and the way he uses the crutch and the exaggerated shift of his whole midline towards the right was producing very aberrant (atypical) behavior in his left side particularly his left lower limb*
particularly distally, the other hypothesis was because of the alignment particularly in the left lower limb he has to pull across to the right side” (Participant #11: Fiona)

The participants were simultaneously making constant comparisons with respect to the current clinical presentation, previous clinical experiences as well as their knowledge on typical, atypical and compensatory motor behavior thereby gaining a deeper and deeper understanding of the clinical presentation whilst seeking to confirm or disconfirm their hypothesis/es, as one describes,

“I was reassessing have I really influenced the placing and distal movement by working this (right) trunk because I have got to know if I am right or wrong about that trunk otherwise I could waste a whole lot of time doing something that’s not necessary” (Participant #16: Leslie)

The participants designed the assessment/treatment environment with a specific task, activity or posture in mind that was meaningful to the client. They utilized the environment to manipulate sensory information, the influence of gravity, and at a sufficient level of difficulty that motor behavior change was promoted but was not so difficult that it was de-motivating, whilst simultaneously evaluating the client’s responses and updating their thinking. A participant describes some of the thinking related to her choice of posture for her client,

“Standing was at least going to give the potential of getting her up against gravity as well as having some kind of relevance to her” (Participant #18: Sarah)

Whilst another describes how she worked towards gaining selective ankle dorsiflexion in her client, a fifty-three year old female three years post a left ischaemic CVA, and then needed to challenge the activity in a more demanding posture,

“In lying the posture was quite easy because there is not a strong influence of gravity, now we need to keep that activity (ankle dorsiflexion) in a more difficult posture, she now has to deal with gravity and maintain the foot and her whole body” (Participant #7: Rosie)

The participants were monitoring their client’s responses during the clinical session on a moment by moment basis, thinking about what they were seeing, hearing, feeling and doing, whilst it was
happening. A participant highlights she is not only listening to her client, but also observing and thinking about his movement in standing whilst he is talking:

“It wasn’t only to gather information but looking at what happens to his body while he is in standing and talking in respect of being more independent in walking which was one of his aims” (Participant #17: Pamela)

The participants identified specific aspects of the clinical presentation to which they constantly referred to assess the influence of the intervention, as one explains,

“It really hit my brain that she couldn’t actually keep her wrist in extension without flexing her elbow, so that was another potential assessment tool that was going to be on-going throughout the whole of the treatment” (Participant #16: Leslie)

The participants were evaluating their own performance as well as their clients, indicating that the participants were reflecting on their thinking, such that the clinical interaction was a learning experience for them both, as one comments,

“We are both in a learning environment and this is especially important” (Participant #17: Pamela)

The participant’s implicit understanding of the Bobath concept, the clinical framework, provides the foundation on which their thinking and interactions are based. The participants are interested in the lived experiences of the person as a whole as well as their perceptual and motor problems. Translating theoretical knowledge into clinical applications, human movement analysis and the use of non-verbal sensory information, visuo-spatial-kinaesthetic perception and facilitation skills, their practical wisdom, are key aspects of the participants’ clinical reasoning process (Figure 5-3 An Interpretive Understanding of IBITA Instructors Clinical Reasoning p.111).

5.6. Discussion

The purpose of this qualitative study was to explicate the clinical reasoning process of expert clinicians in a widely used neuro-rehabilitation approach, the Bobath concept. Understanding how therapists conceptualize clinical reasoning and make decisions in clinical practice is
essential for the development of substantive theory on how therapists decide to do what they do
(Ajjawi & Higgs, 2008);(Holdar et al., 2013).

Three core themes were identified forming the basis of the clinical interaction: 1) A Bobath
Clinical Framework; 2) Person-Centred; and, 3) A Bobath Reasoning Approach (Figure 5-3 An
Interpretive Understanding of IBITA Instructors Clinical Reasoning p.111). Whilst each theme
has its own identity and components, none operate in isolation in clinical practice. This paper
will discuss this study’s results with respect to contemporary reasoning strategies and the critical
role of phronesis, or practical wisdom, in clinical reasoning.

5.6.1. Contemporary Reasoning Strategies

To date clinical reasoning has been discussed primarily as an intellectual activity focused on the
cognitive skills of the clinician such as critical cue identification, thinking, problem-solving and
reflection (M. Fleming, 1991);(G. M. Jensen et al., 1990);(Ian Edwards et al.,
2004);(Wainwright et al., 2010). This has led to the identification of a number of clinical
reasoning strategies, which are common to multiple healthcare professions, including the study
participants. For example, hypothetico-deductive or instrumental reasoning (Payton, 1985);(Ian
Edwards et al., 2004), initially developed to describe the problem solving approach utilized in
medicine (Elstein, Kagan, Shulman, Jason, & Loupe, 1972), was used by the participants to
select critical cues, problem identification and the development of working hypotheses. Pattern
recognition (Barrows & Feltovich, 1987) and knowledge reasoning integration (Schmidt,
Norman, & Boshuizen, 1990), also known as ‘forward reasoning’ closely aligned with expert
practice (Barrows & Feltovich, 1987) was illustrated by the participants identifying similarities
in clinical presentations from past experiences and translating theoretical knowledge into
practice (G. M. Jensen et al., 1990);(G. M. Jensen et al., 1992);(G. M. Jensen et al.,
2000);(Wainwright et al., 2011).

These reasoning strategies have evolved from the ‘Empirico-analytical paradigm’, have
primarily been discussed with respect to their diagnostic nature, are closely aligned with
theoretical knowledge, but also recognize the temporal process of clinical reasoning and
therefore the role of experiential knowledge (Ian Edwards et al., 2004);(Durning et al., 2013).
Concurrently, the participants acknowledged the need for a humanistic, individual, context dependent and reflective approach to client care (Atkins & Ersser, 2008); (Wainwright et al., 2010). The participants sought to understand the client as a person, how their disability specifically influenced their life, acknowledging the influence of the social context as well as cognitive, perceptual and motivational aspects including the need for collaborative goal setting and the importance of developing a therapeutic relationship. Thus they employed what has been previously described as interactive, collaborative and narrative reasoning strategies (M. Fleming, 1991); (Ian Edwards et al., 2004); (Ian Edwards, Jones, Higgs, Trede, & Jensen, 2004).

Consistent with the reasoning strategies proposed by Edwards et al., (2004) the participants utilized reasoning about procedure and teaching, making decisions about task/activity and posture selection, explaining the reasoning behind their interventions, and giving instructions on home programs. They utilized predictive reasoning such that they had expectations of specific interventions as well as reasoning around the movement potential of their clients (Ian Edwards et al., 2004). The participants combined and interchanged their use of the various reasoning strategies individual to their clinical interaction as suggested by Edwards et al., (2004) in a dialectic.

These reasoning strategies have evolved from an ‘Interpretive research paradigm’ which recognizes the influence of context and environment whilst seeking a deeper understanding of the client’s perspective and are aligned with professional practice and personal knowledge domains thereby potentiating the concept of ‘knowledge generation’ through reflective, reflexive clinical practice (Joy Higgs & Mark Jones, 2000); (Wainwright et al., 2010); (Durning et al., 2013).

5.6.2. Phronesis – A Critical Aspect of Clinical Reasoning

Although considerable thought and discussion has revolved around the cognitive elements of the clinical reasoning process, far less attention has been given to professional practice or tacit knowledge. Likewise, little attention has been given to the central role the body plays in physiotherapy practice, and thus clinical reasoning, despite the fact that physiotherapists spend most of their working lives considering the function and dysfunction of the body (Nicholls & Gibson, 2010); (Nicholls & Holmes, 2012). The recognition that clinical reasoning extends beyond the underlying cognitive processes (M. H. Fleming & Mattingly, 2008); (Doody &
McAteer, 2002); (Øberg et al., 2015) has resulted in a call from numerous scholars for a reconceptualization of professional practice knowledge, in particular the Aristotelian intellectual virtue of phronesis or practical wisdom (Kinsella & Pitman, 2012); (Eikeland, 2006).

The central role of the body as a lived body, is a key aspect of the participants reasoning illustrated specifically through the theme ‘Person-centred’, but also visible through the Bobath clinical framework and reasoning approach themes. The lived experiences of the clients before and after their neurological lesion were essential to the participants understanding of the client as a person and their client’s movement problems. Thus the client can be understood as enactively engaged, an agentive body as suggested by Oberg et al. (2015).

The participant as a tool in the reasoning process is illustrated through the ongoing interactive response-based nature of assessment and treatment. Communication may take a verbal form, but it is equally likely to take a non-verbal form through physical contact as well as manipulation of the environment, posture and/or task. The manipulation of sensory information in the broadest sense, known as facilitation, has been identified as a key feature of Bobath clinical practice (Vaughan-Graham & Cott, 2016 (in press)). Oberg et al. (2015), discuss facilitation as enhancing ‘shared agency’ i.e., making an activity or task possible that the client cannot yet do alone, and an important feature of therapeutic practice in order to potentiate independence in daily activities. The co-construction of the clinical interaction by the participants and utilization of implicit and explicit forms of communication, termed ‘intercorporeity’, suggests an embodied inter-subjective aspect to the reasoning process (Øberg et al., 2015).

The participants are selecting and coordinating a wide range of information implicitly on a moment-by-moment basis in order to make a judgment about the next moment in the clinical interaction (Edmondson & Pearce, 2007). The knowledge on which this judgment is made is based on the participants’ practical wisdom (phronesis). Phronesis deliberates and is intrinsic to praxis, or doing, it is directed at promoting action, but it is identified as a different form of knowledge as it is both intellectual and ethical, it promotes wise action (Eikeland, 2006). Praxis is a particular kind of action, it is morally committed, oriented and informed by professional disciplines (Kinsella & Pitman, 2012). For the application of a clinical skill to be relevant and effective i.e., meaningful, requires integration of declarative (knowing what), procedural (knowing how) and conditional (knowing when) knowledge sources (Michels et al., 2012),
clearly an attribute of competence, expertise and thus professional practice knowledge (G. M. Jensen et al., 2000);(Verheyden et al., 2011).

The participants described how they used the information from their hands and body to add another dimension to their clinical reasoning. They integrated a visuo-spatial-kinaesthetic perception of the client’s body into their understanding of the client and the clinical presentation. Visual spatial perception has been discussed in the literature with respect to surgical competence (Risucci, 2002);(Hamdorf & Hall, 2000). Michael Polanyi, cited in Schon (1995) speaks of ‘tactile appreciation’ as a skill i.e., we learn to appreciate these impressions, and Oberg et al. (2015) refers to a proprioceptive and kinaesthetic communication. This visuo-spatial-kinaesthetic perception informs the participants thinking, which in turn informs the applied clinical skills, which further informs the therapists perception and thinking and so on. This is consistent with views on embodied cognition which highlight ‘perception is for action’, and Aristotle’s intellectual virtues being ‘activity-oriented’, such that this action-orientation influences cognitive processes (Øberg et al., 2015);(Eikeland, 2006). However, the relevance and importance of visuo-spatial-kinaesthetic perception, an element of technical expertise, is an aspect of the clinical skills, the practical wisdom, therapists develop through professional practice. The role of practical wisdom, or phronesis, within clinical reasoning is currently missing within the discourse of the therapy professions.

5.7. Conclusions

This study has provided an interpretive understanding of the clinical reasoning process used by expert IBITA instructors. Consistent with the clinical reasoning literature in the therapy professions the IBITA instructors used a variety of reasoning strategies interactively. This study has illustrated an enactive embodied view of clinical reasoning and has illuminated the role of practical wisdom, phronesis, specifically visuo-spatial-kinaesthetic perception, an element of technical expertise, as an integral component of clinical reasoning in this expert group. Further investigation is required into the role of visuo-spatial-kinaesthetic skills, and practical wisdom as a whole, in clinical reasoning of non-expert Bobath therapists as well as in novice and experienced therapists in other specialty therapy areas such as manual and cardiorespiratory therapy.
**In-Vivo Codes**

- It's something that's come over many years of learning about neurophysiology as an independent element (#11)
- There is work in applying that neurophysiology knowledge to patients and that's the second part of how to use theory (#8)
- I was interested in not just what he was doing but how he was doing it (#3)
- What I saw was not a difficulty to move the leg but a difficulty to maintain the upright posture (#15)
- When she was standing her postural sway was increased (#16)
- I am looking for an output and I want this output to be selective and anticipatory in the trunk (#9)
- I'm looking to see if activation of his left lower limb from distal into flexion and extension in a step stance pattern would have an impact in getting a response from the right trunk and lower limb (#11)
- How was the orientation of the upper limb and not only the upper limb but the upper quadrant (#7)
- He wanted to improve his leg for walking and for stairs
- I am modifying the environment to influence the task to make it more at her level (#8)
- I'm using my foot here as well as my hands and the rest of my body (#6)
- The verbal command is important. I'm asking in a specific way "Can you make a long arm" (#3)
- My hands give me much more information than vision, I can see the flexion of the hip, I can see the foot position but I don't know how much tension is there what is the relation between adductor and abductor (#12)

**Sub-Categories**

- Theory
- Applied Theory

**Categories**

- Conceptual Underpinnings
  - Quality of Movement
  - Postural Analysis
  - Postural Stability
  - Movement Expectation
  - Influence of Movement Experience

- Analysis of Movement Performance
  - Integration of Postural Control and Movement
    - Alignment of body segments
    - Sensory Abilities
    - Facilitation-Manipulation of the environment
    - Facilitation-Therapist Handling
    - Facilitation – Verbal Cues
    - Handling - Assessment

**Theme**

**Bobath Clinical Framework**

**Key Aspects of Clinical Practice**
**Figure 5-2** Development of the Theme - Bobath Reasoning Approach
Figure 5-3 An Interpretive Understanding of Expert Bobath (IBITA) Instructors Clinical Reasoning
Chapter 6
Discussion, Implications and Limitations

The overall purpose of this dissertation was to study clinical reasoning in neurorehabilitation from the Bobath clinician’s perspective by: (i) Gaining consensus on a Bobath clinical framework; (ii) Explicating a conceptual understanding of movement; and, (iii) Explicating the clinical reasoning process. In this chapter I will first discuss the role of theory in clinical practice and research with respect to the Bobath clinical framework and conceptualization of movement and how these conceptual underpinnings are integral to understanding clinical reasoning. I will then discuss a consistent theme that has been illustrated through the three studies, ‘The role of alignment and sensory information with respect to the integration of postural control and selective movement and the resulting influence on movement performance’ which highlights from a clinical perspective the constructs that are important to Bobath therapists’. This theme will be discussed with respect to the current literature and the implications for clinical practice and research.

6.1. The role of theory in rehabilitation clinical practice and research

Within the realm of rehabilitation the concepts of theory, models and taxonomies are for the most part invisible in the design of treatment research (Whyte, 2008), despite the abundance of effectiveness studies in biomedicine in which the testing of hypotheses suggests that there is an underlying theory (Costa et al., 2011);(J. Whyte & Barrett, 2012); (Gibson, 2016)(p.5). A theory provides a conceptual overview of phenomena identifying the inter-relationships of assumptions and principles in order to explain and provide a greater understanding of the phenomena (Siegert, McPherson, & Dean, 2005). Not only is there a lack of attention to rehabilitation theory (Siegert et al., 2005) but as this dissertation has identified physiotherapy suffers a similar problem (Hislop, 1975);(C. A. Cott et al., 1995);(Sahrmann, 2014). Whilst rehabilitation requires a theory that addresses ‘change’ in the lives of persons’ with disabilities (Whyte, 2008);(Gibson, 2016)(p.14), physiotherapy requires a theory that addresses ‘change’ in movement (C. A. Cott et al., 1995). Theory provides insight into the aspects of practice requiring investigation such that
the appropriate research questions and designs are developed to inform clinical practice (J. Whyte, 2006). The development of theory and clinical frameworks enables a more systematic approach to investigating clinical practice (Siegert et al., 2005).

6.1.1. Research practice gap

The dominance of post-positivism within the scientific research paradigm privileges some forms of knowledge resulting in the exclusion of alternate forms of knowledge (Holmes, Murray, Perron, & Rail, 2006). This results in the research design driving the research agenda rather than the research question founded on a theoretical basis. Likewise the absence of theory becomes magnified during the process of systematic reviews and meta-analysis as clinical guidelines and recommendations are developed from studies whose theoretical background is either not clearly articulated, or worse, not identified (Kollen et al., 2009); (Canadian Stroke Strategy, 2010). The lack of attention to theory is one of the reasons for the ever-widening research practice gap serving neither research nor clinical practice well (Siegert et al., 2005). Rehabilitation science research has focused on theory testing rather than theory building which seems paradoxical as how can one test a theory if the theory is not clearly elucidated (Siegert et al., 2005). Practice epistemology has been described as the approach that clinicians take towards knowledge that frames their approach to decision-making and care (Shaw & DeForge, 2012). Thus the development of theoretical and clinical frameworks is an essential component not only of clinical practice but also of clinical research (Vaughan-Graham et al., 2015a).

6.1.2. A Bobath Clinical Framework

Although the Bobath concept is one of the most widely used neurological rehabilitation approaches worldwide (Kollen et al., 2009), it lacked a clinical framework identifying the assumptions and principles critical to the Bobath approach (Vaughan-Graham et al., 2015a). Therefore research studies investigating the effectiveness of Bobath interventions varied widely in their clinical application thereby limiting their application to clinical practice (Vaughan-Graham et al., 2015a). The modified e-Delphi study included in this dissertation was the first of its kind to develop the assumptions and principles underpinning Bobath clinical practice with the expert International Bobath Association (IBITA). The Bobath clinical framework identifies the conceptual framework and key aspects of Bobath clinical practice including: (i) A humanistic
approach to care; (ii) The integration of postural control and task performance; (iii) The role of sensory information in motor control and perception; and, (iv) The focus on quality of motor performance. The Bobath clinical framework therefore identifies a theoretical framework providing a foundation on which Bobath therapist’s conceptualization of movement and clinical reasoning could be investigated (Vaughan-Graham & Cott, 2016 (in press)).

6.1.3. Implications for Practice and Research

The Bobath clinical framework provides a starting place for the identification of the unique aspects of Bobath clinical practice requiring consideration in the development of future effectiveness studies (Vaughan-Graham & Cott, 2016 (in press)). However detailed descriptions of Bobath interventions are still lacking in the literature and therefore investigation into the development of core treatment themes is required. Likewise, although the Bobath clinical framework identifies aspects of motor performance important to Bobath therapists it is not clear if these aspects are all inclusive or if some aspects may have been omitted. Additionally, it is not known which aspects of movement performance are of importance to clients with neurological movement problems (C. A. Cott & Finch, 2007). Further investigation is warranted on aspects of motor performance that are important to not only therapists but also clients with movement problems, as well as how these aspects of movement may be quantified in research.

6.2. Conceptualizing movement and clinical reasoning

As discussed in this dissertation there has been limited debate on how movement is conceptualized in physiotherapy (Hislop, 1975);(C. A. Cott et al., 1995);(Sahrmann, 2014), with the dimensions of movement, or aspects of movement performance receiving even less attention (Allen, 2007). However, how physiotherapists understand and think about movement underpins the development of movement diagnoses, which is at the core of how physiotherapists aim to solve movement-related problems. How physiotherapists conceptualize movement is therefore integral to clinical reasoning and is the very essence of evidence-base practice (Megan Smith et al., 2008).

The data gathered from the study using Interpretive Description methods provided the opportunity for data analysis from these two different but inter-related perspectives: (i)
Conceptualization of movement; and, (ii) Clinical reasoning. Both manuscripts arising from this study are the first of their kind to explicate from the clinical perspective the thinking underpinning Bobath clinical practice with the expert international Bobath association (IBITA) and providing insight into how and why Bobath therapists make clinical decisions.

Interestingly, the constructs that arose in the therapists’ conceptualization of movement and clinical reasoning process are consistent with the Bobath clinical framework developed through the e-Delphi study, the movement continuum theory, the contemporary neuroscience and clinical reasoning literature. The overarching theme connecting the three manuscripts, the importance of sensory information with particular reference to alignment and base of support with respect to the integration of postural control and selective movement and the resulting influence on motor performance, will be discussed in light of the contemporary neuroscience.

6.3. The role of alignment, base of support and sensory information with respect to the integration of postural control and selective movement and the resulting influence on movement performance

6.3.1. Postural Control

The current literature describes postural control as a complex sensory-motor behavior mediated by multi-system integration (de Souza et al., 2015). Postural control is discussed in terms of controlling the position of the body in space with respect to postural orientation and equilibrium/stability requiring convergent information from somatosensory, vestibular and visual systems such that gravity, support surface, environment and internal references are considered (Horak, 2006);(Shumway-Cook & Woollacott, 2012)(p.162).

Within the Bobath concept, postural control is viewed as the organization of stability, mobility and orientation of the multi-joint kinetic chain, which is reflective of the individual's body schema in order to maintain, achieve or restore a state of equilibrium during any posture or activity (Vaughan-Graham & Cott, 2016 (in press)). In addition, the Bobath concept considers that the ability of the individual to selectively adapt motor activity and alignment of body
segments with respect to a supporting surface and gravity, provides critical information on the ability of the individual to receive, integrate and respond appropriately to relevant sensory input and is fundamental to the acquisition and development of postural control (Vaughan-Graham & Cott, 2016 (in press)).

Therefore Bobath therapists consider both the relative alignment of the whole body/limbs as well as the alignment within the trunk/limb/s. They place particular weight on the persons’ ability to integrate and selectively adapt to sensory information from the body’s configuration, as well as supporting surface, gravity and context in order to maintain, achieve or restore equilibrium.

In the scientific literature, postural sway, the continuous movement of the centre of mass (COM) in quiet standing (not as a result of external perturbation), is viewed as a measure of postural control/stability (Shumway-Cook & Woollacott, 2012)(p.162);(Powell & Williams, 2015). Based on this understanding of postural control and postural instability the following aspects of motor behaviour are considered integral to postural control research (Shumway-Cook & Woollacott, 2012)(p.162): (i) Centre of Mass (COM), a virtual point at the centre of the total body mass dependent upon body segment alignment (Wu & MacLeod, 2001); (ii) Centre of gravity (COG), the vertical projection of the COM; (iii) Base of support (BOS), the area of the body in contact with the support surface (Voudouris, Radhakrishnan, Hatzitaki, & Brenner, 2013);(Scariot et al., 2016); and, (iv) Centre of pressure (COP), the centre of the distribution of the total force applied to the supporting surface (Alonso et al., 2015).

The variability in postural sway, or postural instability, is traditionally measured using stabilometry, linear measures such as COP excursions, resultant distance or COP path length, sway accelerations or time to contact (TtC) of the COP to the boundary of the BOS (Powell & Williams, 2015);(Martina Mancini et al., 2012);(Haddad, Gagnon, Hasson, Van Emmerik, & Hamill, 2006). However linear measures only provide information on the amount of variability, for example the magnitude or distance, and generally refer to measures of central tendency such as the standard deviation or variance, thereby providing information on the average or mean amount of variability (Harbourne & Stergiou, 2009). Therefore linear measures of variability only provide a limited view on the ‘amount’ of variability of human movement (Harbourne & Stergiou, 2009).
From the perspective of the Bobath therapist, postural control is more complicated than minimizing postural sway. The reliance on linear measures to define and describe postural sway obscures the complexity inherent in human movement (Harbourne & Stergiou, 2009) and does not define or measure the constructs of movement important to Bobath therapists such as the nature of the variability, the ease, rhythm, coordination, specificity and repeatability (Vaughan-Graham & Cott, 2016 (in press)). Interestingly nonlinear measures of variability such as Approximate Entropy (ApEn), which provides a measure of the temporal variability from which the stability of the motor performance can be ascertained, has been shown to be more sensitive to changes in the characteristics of postural sway and are better suited to deal with the complexity of human movement (Harbourne & Stergiou, 2009);(Powell & Williams, 2015).

6.3.2. Selectivity and variability of Movement – The Degrees of Freedom problem

Bernstein, a nineteenth century Russian neurophysiologist, laid the groundwork for the concept of multiple systems working together to produce an optimal movement strategy, providing a framework for the variability and adaptability of context-based motor behavior (Bernstein, 1967);(Latash, Levin, Scholz, & Schöner, 2010);(Muratori, Lamberg, Quinn, & Duff, 2013). Current motor control theories, such as Equilibrium-point (EP) theory incorporating the principle of abundance, and the Uncontrolled Manifold hypothesis have assimilated a ‘Systems’ approach embracing distributed control of the nervous system (Muratori et al., 2013);(Clark et al., 2010). Bobath clinical practice is based on the understanding that sensation, action, perception, cognition and emotion are interlinked and interactive (Vaughan-Graham & Cott, 2016 (in press)) and is therefore congruent with a ‘Systems’ based approach to motor control (M F Levin & Panturin, 2011);(VGraham et al., 2009).

Bernstein coined the term ‘degrees of freedom’ recognizing that movement variability was dependent upon the human body’s substantial degrees of freedom, also known as the ‘principle of abundance’ (Latash et al., 2010);(Gelfand & Latash, 1998), and that efficient voluntary movement depended on the ability of the ‘Systems’ to appropriately minimize the degrees of freedom (Muratori et al., 2013). Bernstein discussed this concept in terms of controlling motor redundancy (Bernstein, 1967);(Muratori et al., 2013);(Latash et al., 2010).
6.3.2.1. Variability of movement

Human movement is complex and variable with many more options available for a given task than is actually needed due to the redundancy inherent within the central nervous system (Harbourne & Stergiou, 2009); (Latash et al., 2010). Functional muscle coordination patterns, also referred to as motor modules or muscle synergies (this is in contrast to the typical use of the term synergies to describe the pathological co-activation of muscles post-stroke such that the motion is fixed and invariable), are suggested to be a principle of neural control reducing the need for independent muscle control but are flexibly combined enabling complex human movement (Safavynia et al., 2011); (Mindy F Levin et al., 2015). Muscle synergies (motor modules) can consist of any number of muscles, individual muscles can belong to any number of synergies and multiple synergies can be simultaneously recruited (Safavynia et al., 2011). Muscle synergies have been proposed for postural responses (Torres-Oviedo & Ting, 2007), locomotion (Cappellini, Ivanenko, Poppele, & Lacquaniti, 2006); (Ivanenko, Poppele, & Lacquaniti, 2004) and upper limb function (Levin, 2015 #3819) and upper limb function (Mindy F Levin et al., 2015) as well as functional coordination between posture and movement dependent upon the task and environment (Haddad, Ryu, Seaman, & Ponto, 2010); (Ting & McKay, 2007). Likewise the complexity and flexibility inherent within muscle synergies is reflective of the highly complex behavioral repertoire developed for skilled motor performance currently obscured by linear measures (Harbourne & Stergiou, 2009); (Amado, Palmer, Hamill, & van Emmerik, 2016). The evidence suggests that in persons post stroke the number of available motor modules and complexity of coordination patterns is reduced resulting in a decreased variability of movement (Clark et al., 2010); (Mindy F Levin et al., 2015).

In the current neuroscience literature motor recovery at the kinematic level is defined as “the reappearance of typical movement patterns and sequences used before stroke for performance of a task”, whilst compensation is defined as “the use of additional or alternate kinematic patterns during task performance” (Mindy F Levin et al., 2015); (Mindy F Levin et al., 2009). In the Delphi study included in this dissertation the Bobath therapists differentiated between ‘atypical’ movement describing motor behavior of the more affected body segments/limbs, and ‘compensatory’ movement describing motor behavior of the less affected body segments/limbs (Vaughan-Graham & Cott, 2016 (in press)). From the clinical perspective this differentiation is
important to enable accurate descriptions of movement problems and thus the development of movement diagnoses in order for interventions to demonstrate their effectiveness (Guccione, 1991). Likewise assessment of isolated muscle strength and tone bears little resemblance to how these muscles are recruited for function (Safavynia et al., 2011). For example, consider the person with a neurological condition who is only able to stand from sitting when the surface is a specific height, this significantly limits this person’s participation due to their inability to vary their movement strategies with respect to a changing environment. From the perspective of the Bobath therapist the use of a grab bar and the less affected upper limb to stand is considered compensation, whilst the movement strategies of the more affected body segments/limbs would be considered from the range of atypical to typical movement.

The Bobath therapist is therefore interested in how the person completes the activity, not just task completion or ‘amount’ of variability. Muscle synergy analysis has the potential to provide more comprehensive information on the evolving nature of muscle synergies in response to individually tailored interventions (Safavynia et al., 2011).

6.3.2.2. Selectivity/efficiency of movement

The concept of ‘efficient’ motor behavior implies an appreciation of the qualitative aspects of movement, the spatial and temporal components of movement (Bernstein, 1967); (Muratori et al., 2013); (McCrea, Eng, & Hodgson, 2002); (Borich, Brodie, Gray, Ionta, & Boyd, 2015). In contrast, movement can also be discussed in terms of metabolic energy cost, the amount of energy expended in achieving the task goal (Lacour & Bourdin, 2015); (Sparrow & Irizarry-Lopez, 1987). Not surprisingly these two aspects of ‘efficiency’ are inter-related as metabolic rate increases with any change to the human musculoskeletal system, or its movement coordination (Collins, Wiggin, & Sawicki, 2015). Although the literature suggests humans adjust step length and arm movement in order to keep energy expenditure low whilst walking (Collins et al., 2015); (Peiffer, Abbiss, Sultana, Bernard, & Brisswalter, 2016), this does not appear to be the case in reaching movements in sitting (Kistemaker, Wong, & Gribble, 2010). However, these aspects of ‘efficiency’ are measuring different constructs of movement. It is conceivable that there may be an initial higher metabolic cost as a person regains motor performance following a neurological lesion that gradually decreases as the person’s movement becomes more typical. For example, regaining motor function in the more affected lower limb to
enable symmetrical sit to stand rather than using only the less affected lower limb, or increased postural and movement demands on activation of the more affected upper limb. It is therefore important to define which aspect of efficiency with respect to movement performance is being studied, as well as the potential interaction.

Bobath therapists use the terms efficiency and selectivity synonymously to describe constraining the degrees of freedom i.e., optimizing postural control, to potentiate an optimal movement strategy i.e., selective movement. Implicit to this conceptualization of movement by Bobath therapists is that the movement comprising postural control is also selective, not rigid or fixed.

One of the mechanisms that the nervous system uses to constrain the degrees of freedom to optimize movement strategies are feedforward postural adjustments. Early Anticipatory Postural Adjustments (EPAs) and Anticipatory Postural Adjustment’s (APAs) are feedforward control mechanisms that minimize the negative consequences of a predicted postural perturbation and for which there is a substantial body of literature (Massion, Alexandrov, & Frolov, 2004); (Krishnan et al., 2011); (Santos et al., 2010a); (Santos et al., 2010b). In addition to EPA’s and APAs, there is a developing body of literature on Anticipatory Synergy Adjustments (ASAs) which are also feedforward adjustments but whose function is to attenuate synergies that would interfere with the performance variable thereby increasing compliance and facilitating effectiveness of the action (Klous et al., 2011); (Ting & McKay, 2007). Feed forward postural adjustments are experience dependent and are influenced by initial postural alignment (Tomita et al., 2011), training (Mouchnino, Aurenty, Massion, & Pedotti, 1992), velocity (Bouisset, Richardson, & Zattara, 2000), reaction time (Slijper, Latash, Rao, & Aruin, 2002) and prediction (A. S. Aruin, 2003). Compensatory Postural Adjustments (CPAs) deal with the actual perturbations and are commonly referred to as fixed support strategies such as ankle and hip strategies, and change in support strategies such as stepping reactions and protective upper limb strategies (Shumway-Cook & Woollacott, 2012); (Santos et al., 2010a); (Santos et al., 2010b). Approximately six muscle synergies have been identified for human postural responses (Torres-Oviedo & Ting, 2007), however variability in postural control is a necessary function of motor behavior to accommodate for the internal and external perturbations constantly experienced by the body (Haddad et al., 2010); (Önell, 2000).
Likewise, typical limb movement comprises joint motion at several joints representing multiple degrees of freedom mediated by many muscles. However, persons with no neurological condition demonstrate similar movement patterns during reaching (D’avella, Portone, Fernandez, & Lacquaniti, 2006; McCrea et al., 2002) and locomotion (Lacquaniti, Ivanenko, & Zago, 2012). During reach, hand paths are straight or slightly curved requiring coordination of shoulder and elbow rotations demonstrating kinematic and kinetic regularity whilst simultaneously demonstrating considerable variability and complexity in the underlying muscle patterns (D’avella & Lacquaniti, 2013);(McCrea et al., 2002). Whilst for persons with stroke, reaching is described as slower, segmented and less stereotypical and those with moderate/severe stroke demonstrate accompanying trunk compensations (Pain, Baker, Richardson, & Agur, 2015);(Mindy F Levin et al., 2015);(Michaelsen et al., 2006). Similarly for adult human locomotion, the trajectories of the COM and feet are highly consistent, whilst the EMG activity of trunk and lower limb muscles consistently represents a combination of four to five basic patterns (Lacquaniti et al., 2012). Whereas for persons with stroke, most paretic legs demonstrated only two or three modules, and those with fewer modules demonstrated a greater degree of muscle co-activation as well as poorer walking performance (Clark et al., 2010). The evidence suggests a reduction in muscle synergies is correlated with walking speed and balance measures in standing (Chvatal & Ting, 2013). This suggests a common set of muscle synergies may form a motor repertoire shared by locomotion and reactive balance strategies (Chvatal & Ting, 2013). Therefore muscle synergy analysis has the potential to provide valuable information with respect to muscle coordination, an aspect of motor performance illustrating the nature of variability rather than the amount of variability, and which may be generalizable across different tasks (Chvatal & Ting, 2013). This provides a theoretical basis to the clinical assumption within the Bobath concept that postural control and selective movement are viewed as inseparable and interdependent and that motor performance in one task influences motor performance in a different task (Vaughan-Graham & Cott, 2016 (in press)).

6.3.3. Sensory Information

Fundamental to Bobath therapists’ conceptualization of postural control, is the individual’s ability to receive, integrate and respond appropriately to sensory information (Vaughan-Graham & Cott, 2016 (in press)). Bobath therapists consider somatosensory, visual, and vestibular
information as well as cognition, perception and emotion therefore considering the task and environment (Vaughan-Graham & Cott, 2016 (in press)).

Base of support (BOS) and Center of Mass (COM) (dependent upon body configuration), are two aspects of postural control commonly discussed in research (Wu & MacLeod, 2001);(Voudouris et al., 2013);(Scariot et al., 2016). Although Bobath therapists also consider BOS and body configuration their clinical perspective illustrates the role of sensory information in their interpretation of these two important aspects of postural control.

6.3.3.1. Base of Support

BOS in the current literature focuses on the mechanical aspects of the BOS, the contact area, boundaries, texture of the BOS (Anderson, Deluigi, Belli, Tentoni, & Gaetz, 2016), whereas the Bobath therapist considers not only these aspects of the BOS but the sensory perceptual aspects of the BOS, the interactive relationship between the body segment and the base of support in respect of gravity, the task and environment. The evidence suggests cutaneous plantar and ankle proprioceptive information contribute to Anticipatory Postural Adjustments and postural control (Anne Kavounoudias, Roll, & Roll, 2001);(Lin & Yang, 2011). In addition multisensory integration occurring through distributed cerebral networks (cortical and subcortical) underpins human movement perception (A Kavounoudias et al., 2008).

The shape, depth and alignment of the body segment (i.e., foot to support surface) provides valuable information on how the body segment interacts with the supporting surface, just as foot/paw prints were used by primitive man to make deductions about the activities of animals or humans (Sutherland, 2005). Thus the reliance on COP measurement in postural control research which only provides information on the centre of the distribution of the total force applied to the supporting surface (Shumway-Cook & Woollacott, 2012) does not take into consideration the interaction of the whole body segment in contact with the supporting surface and the level of sensory integration afforded through the body segment. Likewise ‘Ground Reaction Force’ (GRF) is defined as ‘the force exerted by the ground in response to the forces a body exerts on it’ (Kent, 2006). However, the use of GRF when investigating postural control assumes that the person is exerting a typical amount of force and that the person can vary the forces they are exerting depending upon the task and context. Unfortunately, this is often not the case for
persons with neurological conditions who have altered muscle tone and maybe generating either too much or too little force. Consider for example a person in standing with a left hemiplegia, whose contact of the left foot to the floor is limited to the lateral border and forefoot, the toes are flexing, the heel is not in contact and the person is generating significant force through the forefoot. This person with this movement problem is unable to achieve an interactive relationship of the left foot with the support surface and would likely have great difficulty walking on sand or soft terrain but would be able to generate a significant COP measurement derived from a force plate which would likely be invariable due to the person’s inability to voluntarily change the tonal distribution of the foot and lower limb.

Therefore, to investigate movement problems such as postural control of persons with neurological conditions consideration of how the whole body segment interacts with the supporting surface from a sensory-perceptual perspective is required.

6.3.3.2. **Body Configuration - Alignment**

Bobath therapists place significance on the influence of alignment and selective movement of body segments, the stability, mobility and orientation of the multi-joint kinetic chain with respect to postural control (Vaughan-Graham & Cott, 2016 (in press)). Critical to Bobath therapists’ conception of the maintenance and restoration of postural control is the consideration of sensory information arising from the active alignment, selective movement and orientation of the body, and thus the role of body schema (Vaughan-Graham & Cott, 2016 (in press)).

The evidence suggests sensory information (somatosensation, vestibular, vision etc.) modifies somatosensory maps (Borich et al., 2015) and is one mechanism attributed to sensory information influencing the planning, execution and control of motor behavior (Borich et al., 2015);(Tomita et al., 2011);(Caronni & Cavallari, 2009);(Kouzaki & Masani, 2008). Bobath therapists consider the role of sensory information in motor control and perception a key aspect of clinical practice (Vaughan-Graham & Cott, 2016 (in press)). Bobath therapists are therefore not only interested in the COM which is a virtual point at the centre of total body mass (which is dependent upon body segment alignment), and/or the COG which is the vertical projection of the COM (Shumway-Cook & Woollacott, 2012), but the active alignment of one body segment to another, and the BOS, with respect to gravity, task selection and environment (Vaughan-Graham
Facilitation is a skilled aspect of Bobath clinical practice in which Bobath therapists’ manipulate sensory information through the use of the environment, task selection, verbal and non-verbal cues to potentiate a typical movement experience (Vaughan-Graham & Cott, 2016 (in press)). This is particularly important to Bobath therapists as the evidence suggests that abnormal processing of somatosensory information contributes to atypical motor behavior (Borich et al., 2015).

Consider for example the person with a neurological condition whose single leg stance on their more affected leg is characterized by knee hyper-extension, hip flexion, adduction and internal rotation and trunk side-flexion to the more affected side. This person may be able to maintain their COM within their BOS during single leg stance on the more affected side, but their alignment suggests that the person is unable to selectively adapt motor activity and alignment of body segments with respect to the BOS and gravity (Vaughan-Graham & Cott, 2016 (in press));(Wu & MacLeod, 2001). In addition the sensory information arising from the alignment and muscle synergies will not be reflective of typical motor behavior and therefore atypical motor behavior will be reinforced (Borich et al., 2015);(Malmström, Olsson, Baldetorp, & Fransson, 2015).

Thus the consideration of alignment of body segments/limbs and related muscle synergies may provide useful information with respect to identifying typical and atypical motor behavior providing a method to investigate interventions such as the Bobath concept which aims to improve motor performance.

6.3.4. Implications for Practice and Research

The conceptualization of movement by Bobath therapists provides a theoretical framework of the movement constructs important to the Bobath concept identifying key aspects of clinical practice that require inclusion when investigating the Bobath concept. The integration of postural control and selective movement, from the clinical perspective of expert Bobath therapists, and how this movement construct intersects with the current evidence with respect to the concepts of efficiency, base of support, alignment and sensory information identifies aspects of Bobath clinical practice that remain to be investigated. Similarly, therapist conceptualization of movement lays the groundwork on how Bobath therapists group client characteristics other than
medical diagnosis potentiating the development of a Bobath Taxonomy enabling clients to be appropriately grouped in intervention effectiveness studies.

Lastly, the role of sensory information in Bobath therapist’s conceptualization of movement and how it informs the clinical reasoning process through the therapists’ visuo-spatial kinesthetic skills has highlighted the role of practical wisdom. Further investigation into the visuo-spatial kinesthetic perception of expert and non-expert therapists in other practice areas would provide valuable information on the presence, development and role of this skill in clinical practice.

6.4. Limitations

This dissertation is associated with several limitations which will be described below.

The primary limitation of this dissertation is that this author is a member of the International Bobath Instructors Training Association (IBITA), particularly as the author becomes a research tool within the data analysis process of the study using Interpretive Description methods. Therefore, there are a number of factors requiring consideration. Firstly, this author is known to a large proportion of the IBITA membership, whilst this may have facilitated participation in one or both of the studies, it may also have discouraged participation. Participation may have been influenced by similarities in personality and instructor style, but at the same time other IBITA members not so familiar with the author or believing to have a different instructor style may have been motivated to participate to ensure their voice was heard. During the recruitment process for both studies, to minimize the influence of the author as an insider, recruitment primarily occurred through the IBITA Executive Committee and the IBITA country representatives. Recruitment to the Interpretive Description study was limited to the locations Melbourne, Madrid, Brescia and Lisbon therefore some participants would not have been able to participate purely because they could not be available in any of the locations at the pre-determined time. However, despite this limitation, recruitment to the study included all three instructor categories with widely varying instructor experience, a total of seven countries were represented, and only seven of the twenty-one participants used English as their primary language. However, the researcher being an insider enabled access to the IBITA which would not have otherwise been possible. Also IBITA could be assured that the research undertaken would be analyzed with tacit understanding and not misrepresented.
For the Delphi study participation remained confidential, anonymity was not possible due to limitations of the survey software ‘Fluid Surveys’. Development of the initial Delphi statements were verified by an independent study auditor to be consistent with the literature and comment boxes were provided alongside all statements in all survey rounds to ensure participants could freely comment and make suggestions. This was included in the study design to ensure that the author did not constrain statement development. During the Delphi data analysis phase, content analysis of all comments were reviewed by an independent study auditor, in addition to this author, to ensure all comments were considered and revisions and construction of new statements were consistent with the comments. Participation of the IBITA membership in the Delphi survey was limited to 44% in Round One representing a satisfactory response rate (Dillman, 2000). However, as a result of the 44% response rate in Round One the views of only a limited number of IBITA members, 89 out of 204, contributed to the development of the clinical framework. However, with the formation of a Delphi Panel from Round One respondent’s response rates were consistently high, 72% and 70% in Round Two and Three respectively. In addition, although the Delphi was undertaken in English the number of respondents for whom English was a second language (ESL) was consistently high in all Rounds.

For the Interpretive Description study, some IBITA members may have chosen not to participate as this author was the person video-recording the client-therapist interaction. Also the video recording had the potential to influence the content of the session. However, the research participants are familiar with being watched and video-recorded as part of their role as clinical educators. The researcher aimed to be as unobtrusive as possible throughout the session and did not participate in any of the clinical sessions in any way. As this study utilized video-assisted retrospective verbal reporting, the participants may have exercised judgment before their interview, thus verbalizing their long and short-term memory. Participants were explicitly asked to verbalize only what they were thinking at the time. With think-aloud protocols, the participants have less opportunity to introspect, potentially characterizing clinical reasoning more reliably (Arocha & Patel, 2008)(p.196-197). However, think-aloud protocols slow down the entire clinical interaction such that it may no longer be reflective of actual clinical practice. With all verbal protocols there is the assumption that the participants can be explicit about their entire clinical reasoning process, but consideration needs to be given that perhaps participants know more than they can say, or even perhaps they misrepresent the process. A significant
limitation of being an insider is the implicit knowledge one holds and therefore not sufficiently interrogating concepts arising during the interview process. As this author transcribed all transcripts verbatim, this provided an opportunity to reflect on questions that may have been asked to gain a deeper understanding of the participant’s thought processes. Also as the data collection process was in four distinct phases this provided time to reflect between data collection phases and time for this author to become more aware of one’s implicit understanding of movement and clinical reasoning from the perspective of the Bobath concept. In addition, an independent study auditor reviewed a random selection of transcripts to ensure adequate questioning was being undertaken. A code book, including a definition of each code, and corresponding data from each respective participant was developed and the development of categories and themes at successive levels of data analysis were reviewed by three independent reviewers to ensure all codes, categories and themes were reflected in the data.

Lastly, although the Interpretive Description study collected a significant amount of data and the data appeared to reach saturation as no new codes, categories or themes were emerging, participation by some countries were not included in the data collection and therefore alternative views may have been omitted. However, although participation included seven different member countries, variety in instructor status and level of instructor and clinical experience all transcripts gave rise to similar codes enabling development of core constructs with respect to the participants’ conceptualization of movement and an Interpretive model of clinical reasoning.

The implementation of the Bobath clinical framework, Bobath conceptualization of movement and Interpretive model of clinical reasoning is required in future research to investigate their goodness of fit in non-expert Bobath groups to determine if additional elements require inclusion, as well as with non-Bobath groups to determine if Bobath clinical practice differs from other neuro-rehabilitation approaches and other areas of physiotherapy practice.

6.5. Conclusions

Explicating clinical reasoning in the context of clinical practice illuminates the tacit knowledge clinicians use to make wise judgments with respect to individual clients. This thesis has enabled the development of a clinical framework, the assumptions and principles that guide the clinical practice and thus clinical reasoning of an expert group of neuro-rehabilitation therapists (IBITA).
Change in movement performance is a key aspect of this neuro-rehabilitation approach. Therefore, therapist’s conceptualization of movement is integral to their clinical reasoning and highlighted the aspects of movement critical to their understanding of the integration of postural control and selective movement with respect to task performance. This practice epistemology underpins the clinical reasoning process and exposed the cognitive and clinical skills, the practical wisdom, implicit within expert clinical practice required for sound clinical reasoning. Therefore ‘knowing what’, or declarative knowledge, is insufficient for clinical practice, ‘knowing how’, procedural knowledge, and ‘knowing when’, conditional knowledge, are equally important. The rehabilitation sciences therefore require a multi-dimensional knowledge base. The clinical framework, conceptualization of movement and clinical reasoning model provides a foundation on which to base entry-level practice instruction, post-graduate education, instructor training and research of this widely used neuro-rehabilitation approach, the Bobath concept.
References


injury using locomotor training-based rehabilitation. *Archives of Physical Medicine & Rehabilitation, 93*(9), 1508-1517. doi:http://dx.doi.org/10.1016/j.apmr.2011.01.024


Appendices

Appendix A Interview Guide & Instructions

**Interview Instructions** (from Payton 1985, original source Barrows & Tablyn 1980)
I would like to know what were your thinking processes as you worked with your patient. Please express any thoughts you had about the nature of the patient’s problem/s, the significance of any assumptions or observations, the reasons for particular questions you asked or things that you did during the clinical session, and concerns you may have had about management and treatment of the patient’s problem/s. In addition, please mention any concerns you have about the patient in general, this setting, the room, or any other factors that you think are important.
Please don’t let information you now have about the patient, influence your comments about what you were thinking at the beginning of your encounter, as we review the video. I want to know exactly what was going on in your mind, at that time.
Please do not assume that I have any set expectations, as to what should have been going on in your mind. Do not formalize, or express thoughts or ideas, that did not actually occur at the time. For this evaluation to be successful, you must attempt to relive your thought processes as accurately as possible.
I will stop the video recording at any point, at which it occurs to either you, or myself, that it may be valuable for discussion about thoughts and ideas.
Please let me know if this is perfectly clear or if you have any questions.

**Interview guide for Video Playback of clinical session**

Open ended questions will be primarily used as these have a greater tendency to yield rich data, for example:
“Could you tell me about what you were thinking about while…..”
Some examples of potential questions may include:
1. Tell me what you were thinking about as you assessed and treated this patient?
2. What do you think are the main problems for this patient? How did you come to these conclusions? What evidence did you use? How did you know to use that evidence and where did you learn that?
3. What was your problem-solving strategy? How did you decide how you were going to treat the patient? Why did you decide to do what you did? Did you have a specific goal in mind?
4. What knowledge did you draw on to determine how to treat this patient?
5. Tell me more about how your hands influence your thinking process?
6. What role do your hands play in your clinical reasoning process?
7. What advantages did the treatment setting give?
8. What restrictions did the treatment setting place on your treatment?
9. What was the influence of the patient’s comorbidities, on what you chose to do in the treatment session?
10. On review of the patients medical history, and current medications, how did this impact on your thinking about the treatment that you provided?
Appendix B Professional Profile Data Collection Form

Thank you for agreeing to participate in the research study titled:

The Bobath concept - Clinical Reasoning and Core Treatment Themes

Please take a few moments to complete the following table below, and return to Julie Vaughan-Graham at your earliest convenience, either by email to julie.vaughan.graham@mail.utoronto.ca or by fax to 416 490 9961.

Please attach a copy of your current professional indemnity insurance certificate, including a cover note from your insurer stating that your coverage includes this specific research.

Many thanks for your cooperation.

<table>
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<tr>
<th>Participant Name</th>
<th>College Registration number</th>
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Education (Degrees), Institution & Year Attained
Grad.Dip.Phys.=Diploma in Physiotherapy, BSc=Bachelor of Science, DPT=Doctorate of Physiotherapy, MSc=Master of Science, PhD=Doctor of Philosophy

<table>
<thead>
<tr>
<th>Years of Clinical Experience</th>
<th>Year gained IBITA Instructor Status</th>
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<tbody>
<tr>
<td></td>
<td>B=Basic, A=Advanced, S=Senior</td>
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</table>

Current Practice Setting
PP=Private Practice, AC=Acute Care, IPR=In-Patient Rehabilitation, OPR=Out-Patient Rehabilitation, HC=Home Care

<table>
<thead>
<tr>
<th>Teaching Experience (other than continuing education)</th>
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<tr>
<td>CI=teaching in entry level to practice clinical education, Academic=teaching in academic classroom</td>
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How much time do you spend on average on a monthly basis in direct patient care and teaching commitments eg 50:50, or 20:80
<table>
<thead>
<tr>
<th>Question</th>
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<tr>
<td>What attributes do you think are required by a therapist for successful clinical reasoning?</td>
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<tr>
<td>What activities have been important in the development of your clinical reasoning skills?</td>
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<tr>
<td>How do you think clinical reasoning should be taught to a less experienced therapist?</td>
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<tr>
<td>Do you have any other thoughts or suggestions that you would like to add?</td>
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